BRITISH FERNS

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A HISTORY

OF

BRITISH FERNS

BY

EDWARD NEWMAN

MEMB. IMP. L.-C. ACAD.; F.L.S., F.Z.S., &c., &c.

Fifth or People's Edition.

WITH PLATES AND GLOSSARY,

ALSO

DIRECTIONS FOR DRYING FERNS, AND FULL INSTRUCTIONS WHEN TO FIND, HOW TO DISTINGUISH, AND HOW TO CULTIVATE EVERY BRITISH FERN.

Mo. Bot. Garden.
1897.

LONDON:

JOHN VAN VOORST, 1, PATERNOSTER ROW.

"Oh, attend,
Whoe'er thou art, whom these delights can touch,
Whose candid bosom the refining love
Of Nature warms; oh! listen to my song;
And I will guide thee to her favourite walks,
And teach thy solitude her voice to hear,
And point her loveliest features to thy view."

"An eternal book,
Whence I may copy many a lovely saying
About the leaves."—KEATS.

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Having watched with great satisfaction, I may even say with pride, the sale of expensive Editions of my British Ferns, and feeling conscious that I have originated, fostered, and in a measure matured a new taste, study and occupation among my countrymen, I have thought it desirable to extend the influence of this, my labour of love, for such it has truly been. Hitherto the volume has passed exclusively into the hands of the upper and middle classes; but now it is my ambition to possess a third class of readers and approvers, — a class equally numerous and equally important, — the "People" properly so called: I am convinced that the disinclination to spend twenty-five or even eighteen shillings on a book, by no means implies the inability to understand and appreciate its teaching, or the absence of that refined taste and true love of Nature

which is, and ever must be, a quality of mind and not of pocket or position.

The cottager who has but a few square yards of garden, a humble portico of trellis-work, or even a single window-sill at his command, may render these, or either of them, so pleasing and ornamental as to attract the notice of every passer-by, and be to himself a constant source of pleasure far more refined, far more satisfactory to his mind, than those which are constantly, and perhaps too ostentatiously, paraded before his eyes. How small is the amount of labour and of money required to gratify this taste! Nature, left to her own resources, will often set up for us patterns, models of ornamental gardening, which will tax all our ability to imitate, and which we can never excel; and yet how easily is this accomplished! For climbers, like the scarlet-runner, she provides twigs and boughs to take hold of; for creepers, such as moneywort, she prepares a flat surface, or perhaps a ledge, from whence their bright blossoms may hang in the sunshine; for ferns, all except the weather-braving bracken, she provides shade and moisture, perhaps scoops out a little cave, carpets the floor with

mosses and lichens, shades it with a spreading beech tree, waters it with a dripping rock. All this may be done, if you will but become a loving and obedient pupil of Nature.

Ferns constitute so beautiful a portion of this world's clothing, whether they drape our ruins with their floating and feathery foliage, wave their tresses from our weather-beaten rocks, or light up with evergreen verdure the crowns of picturesque forest-trees, or the formal banks of our hedge-rows, that it seems next to impossible to gaze on them without feelings of pleasure.

Wherever, in days long past, some convulsion of the earth has opened a chasm in the mountain side, water is sure to flow, sometimes leaping noisily from rock to rock, sometimes just percolating the loosened stones, or dropping with the tinkling cadence of fairy bells,—there too, on each side, is sure to be found a picturesque growth of dwarfed forestry, abundance of saturated moss, and a great variety of ferns swayed to and fro by the mountain breeze and dripping with the spray of waterfalls. Such chasms are there at Ponterwydd, Pont-y-Mynach, Water-

break-its-Neck, Cwm Idwel, and a hundred other places familiar to everyone who has wandered in these delightful regions. There the Beech Fern, the Oak Fern, the Mountain Fern, the Hart's Tongue, the Polypody, the Brittle Fern, and the Maidenhair are almost invariably present; and there occasionally the less abundant Green Spleenwort, and the somewhat capricious Hard Fern, besides the Prickly Fern in all its perplexing diversities of form. On the rocks, too, and intermixed with the water-laden mosses, the two Filmy Ferns may frequently be found.

Leaving Wales, my walks in search of ferns were extended to Scotland and Ireland, more particularly the latter, and there I found the beautiful Bristle Fern in its island home, fringing the waterfalls, and loaded with rain-drops, glittering like diamonds in a ray of sunshine that had contrived to find its way through the tangled forestry above: there, too, I found the ground, in the deepest, dampest shade, hidden by a luxuriant growth of the lovely Bree's Fern, loading the air with its powerful hay-like odour as I trampled on its graceful fronds; and there, too,

I saw the delicate Filmy Ferns climbing the forest trees, and hiding the bark from view.

Whenever I met with a fern that I thought would repay the trouble of removing, I invariably noticed the locality in which it grew; whether it was naturally exposed to sun, rain and wind; whether it preferred a horizontal or perpendicular surface; whether its fronds were rigid and erect, or lax and pendulous; whether its roots enjoyed depth of earth, or were simply "moored in the rifted rock."

A fernery to supersede the necessity for care and attention, and that really is the great desideratum, should possess abundant space, pure atmosphere, variety of surface and a fall of water; but these are conditions rarely found at hand, and therefore care and attention are necessary in ninety-nine cases out of every hundred, because, instead of finding the conditions ready to our hands, we are compelled to improvise conditions of our own; and having once determined to go into the matter thoroughly, we shall find there is scarcely a plot of ground a few yards square, even in a smoky metropolis, but can be rendered available for the purpose: the earnest and skilful cultivator may

almost accomplish whatever he desires, and may even cause the artificial to equal in beauty the natural fernery.

First of all, the character of the soil must be carefully considered; if your garden is on the chalk or clay, you must remove the surface-soil and substitute a mixture of peat-earth, sand and loam, allowing the peat-earth largely to preponderate. Then a fernery should never have a flat surface; walls and banks must be introduced, in order to obtain the inequality in which Nature delights. If you wish to see how Nature manages these things, I especially recommend a trip to Tunbridge Wells, and to Eridge and the High Rocks in the immediate neighbourhood of Tunbridge Wells. I can scarcely imagine a greater treat than an attentive examination of that *Bois des Roches*, as the French call similar scenery on the opposite coast of France. The rocks are scattered about in the woods as if by the hand of a giant; sometimes a single rock, sometimes a handful of rocks seem to have been thrown down together, and sometimes a whole row of rocks extends, in single file, for half a mile among the trees. The material of the rocks is sandstone, and the surface seems to

be always moist, and covered, except where fern-collectors and fern-dealers have stripped it, with a coating of mosses, powdery lichens, and seedling ferns; nothing can exceed the loveliness of such fairy gardens, and it must always be the leading object of the cultivator to imitate this loveliness as best he may.

Sandstone, like that of Tunbridge, is not to be obtained everywhere, but the *old red*, and even limestone, *may* be substituted when the right material is not to be obtained. After all, it is merely a question of cost, the cost of transit; but now that our railways permeate every county, the cost of transit is not so formidable as it used to be. Having stated that sandstone is best, let me next explain what is worst, and what no one with a grain of good sense or good taste will ever use or even admit into fernery or garden, I mean clinkers; these hideous monstrosities repel every attempt of vegetation, and, in spite of all the care and expense that can be expended on them, retain their pristine ugliness under all circumstances, even though painted and varnished as we sometimes see them. Next to clinkers in ugliness we may class flints, an equally favourite

decoration with the gardeners; and next to flints in the category of things to be avoided, I must mention wood of all kinds. Trunks of trees with their boughs chopped off and the roots stuck upwards, in addition to their ugliness, possess the great disadvantage of introducing myriads of wood-lice, the devastating propensities of which can only be learned by actual experience.

In the arrangement of the masses of stone there is great scope for the exhibition of taste; but taste cannot be taught by printed rules; it must either be intuitive or result from experience. Even formality becomes beautiful in the hands of Nature herself or Nature's students; for instance, what structure can be more formal than a well; the hollow of a symmetrical cylinder, the stones or bricks of which it is built ranged round, circle after circle, with the most unimaginative sameness: but many a structure of this kind in the South of England and in Ireland is draped with the pendant fronds of the Hart's Tongue, and in France and Italy with True Maidenhair. I need not dwell on the beauty of scenes like these. Even that most formal and

uninviting of all conceivable objects, a railway cutting through a sandstone or limestone district, becomes beautiful when time has clothed it, which it inevitably will do, with mosses, lichens and ferns; and what at first seems unaccountable, hundreds of species of cryptogamous plants not known to exist in the neighbourhood are certain to make their appearance as soon as this agreeable home is provided for their use. Let any one who can afford to spare time and money for the undertaking make a like cutting in his garden: it need not be straight like a railway cutting, and its banks may be perpendicular and not slanting; make it eight feet deep and four feet wide, and its sides will afford the most congenial habitat for all kinds of cryptogamic vegetation. Our British Ferns will grow vigorously in such a cutting, without care or protection of any kind, and a number of exotics will there survive the inclemency of our severest winter; but let us go a step further; let us cover this under-ground fernery with glass, and let us introduce an iron pipe throughout its length, and fill this pipe with heated water or air, and then the most tender ferns of the tropics may be

introduced, and the sides may be clothed throughout with graceful and luxuriant Lycopodiums and delicate Filmy Ferns.

And now I must say a few more words about the use of glass for ferneries. In almost every part of England there is an absolute necessity for a covering of glass, the advantages of which are manifold: in the first place, the ferns are thus entirely protected from the effects of wind, so fatal to the perfect development of their tender and delicate fronds, and also from the worst effects of frost. The glass covering may be of any form that taste may dictate or convenience require. It is quite impossible that any resident in the neighbourhood of great cities should have failed to observe the continued falling of smoke-flakes, or "smuts," as they are usually and not inappropriately called; it is a curious but well-ascertained fact that these smuts falling on ferns actually destroy the spot on which they fall, causing a yellowish speck on the leaf, but that they improve and enrich the water with which they may be mixed. The glass canopy, of whatever shape or character it may be, receives these smuts as they fall,

and preserves the ferns from the injury they would cause; then the first shower of rain washes them off the glass, and thence into the rain-gutter and the tank which supplies water not only for the fernery, but for the garden generally. Thus is a noxious article not only prevented from doing an injury, but actually turned to beneficial use.

There are many active agents at work, charged with the duty of effecting that change which, amongst all created beings, is a necessary accompaniment of existence; and the office of every agent is to hurry forward the inevitable process; the softly descending rain which promotes the rapid growth of a sweet pea, and the burning sun which ripens its seed, are equally the unreasoning and the unavoidable agents provided for its destruction; wind and frost also do their part; and the result is always the same; the more you hasten maturity the shorter do you render existence. Now if we seek for the conditions most favourable to the healthy growth of ferns, and refer for the information to Nature herself, we shall find them rather in gradual and uniform, than in rapid development; in protection from the sun's rays; in

the uniformity and excess of atmospheric humidity; in the absence of extremes of heat and cold; and, if these extremes must occur, in the gradual transition from one to the other; and finally, in that perfect stillness of the atmosphere which is to be found only in caves, fissures of rocks, wells, and a few similar situations.

Now it has long been known that a covering of glass is the best artificial substitute for Nature's care: from time immemorial the gardener has been aware of this, and has most cleverly availed himself of the knowledge; the hothouse, the greenhouse, the conservatory, the pinery, the melon-pit, the cucumber-frame, the propagating-glass, nay, the very hand-glass that we see so abundantly in our market-gardens, are so many unquestionable witnesses to the early use of glass for this very purpose; in fact, there is reason to believe the use of the hand-glass is almost coeval with the invention of glass itself. To Mr. Ward we are indebted for bringing the hand-glass into our halls and our drawing-rooms, for placing it on the window-sills of our chambers, and for making vast improvements in

the convenience of its form and the elegance of its appearance; indeed for transmuting the gardener's hand-glass into the Wardian Case. I believe it to be a very great mistake to suppose that these truly ornamental little gardens possess any other advantages than those I have described; that they exclude sulphurous acid gas, as suggested by Professors Turner and Christison, or hydrochloric and muriatic acid gases, as supposed by others, must certainly be an error: we add no gases to those which externally surround the case, and we keep none away: we cannot exclude them. With ferns atmospheric humidity is one great desideratum; perfect stillness is another; equal temperature, avoiding extremes or sudden changes, is a third; the exclusion of fuliginous matter, and indeed of all dust and impurities, is a fourth; and the modification of solar rays, which should never enter your fern-house, is a fifth; thus the injurious power of natural agents is restrained and restricted, whilst the beneficial power of natural agents is retained and cherished, and its efficacy ensured: such is the effect of glass.

Concerning the cultivation of each species of fern a few instructions will be given in the proper place; but one of the most interesting branches of fern culture is raising the various species from seed. Every fern, if dried and pressed when the back is covered with ripe seed, leaves on the paper a quantity of brown dust: that brown dust is the seed, and is in a perfectly ripe state and quite ready for sowing: shake the dust from the paper on a dinner-plate; and then, having a small quantity of finely-sifted and sandy peat-earth ready to your hand, scatter it lightly over the seeds until they are completely covered; stir the earth about until the seeds have attached themselves to the peat-earth, and then spread this earth containing the seed very lightly on the surface of more earth prepared in a flower-pot or saucer, carefully covering the whole tightly with a bell-glass or propagator, and excluding, as far as possible, all communication with the dry and uncongenial air outside. In a very few weeks the surface of the earth will be covered with an olive-green coating of germinating fern-seed, from which here and there minute convolute fronds will shortly

make their appearance: but the earliest leaves of a fern are altogether unlike those which it finally assumes; they are very small, flat, olive-coloured and scale-like; and these are produced in such multitudes that scarcely one out of every thousand has any chance of arriving at maturity.

There is, and always will be, a great difficulty thrown in the path of the learner by the introduction of new names: this practice is not confined to the juvenile scribblers who are inditing their first publication, but may be traced backwards to old and most respected authorities: it is a sort of monomania with scientific writers; thus even in Sir J. E. Smith's 'English Flora,' *spicant* of Linneus is changed into *boreale; robertianum* of Hoffmann is changed into *calcareum; alpinum* of Bolton is changed into *hyperborea; aculeatum* of Linneus is changed into *lobatum; montanum* of Vogler is changed into *Oreopteris; germanicum* of Weiss is changed into *alternifolium; Scolopendrium* of Linneus is changed into *vulgare; speciosum* of Willdenow is changed into *brevisetum;* and so on. Now not one of these changes arises from ignorance or

prejudice, or any similar cause; but entirely from a conviction on the part of the author that in changing these names he was performing a necessary duty, and conferring a benefit on the student; indeed he weighed the matter well, and firmly believed that the later were the better names: no one who has studied, as I have done, the beneficent and candid character of Sir J. E. Smith, would hesitate to conclude, as I conclude, that in every change he proposed he conscientiously believed he was doing a service to his favourite science; he thought the newer names better than the older; more classical or more euphonious, or more descriptive, or possessed of some other decided advantage. Several more recent authors who do not possess the merits of our greatest English Botanist, have yet thought themselves entitled to follow his example in changing the names of ferns, and thus we are encumbered with a most unhappy confusion of names; and collectors are continually saying, "I follow Smith," or "Hooker," or "Babington," or even "Bentham" or "Walker Arnott," and seem rather to take pleasure in asserting their right to

this diversity of practice. So far from following them I have never taken any author as a safe guide throughout, but have invariably given to each species the earliest name that I know it to have received: there is one seeming exception to this rule, and that is in the name "cristatum," which I have purposely omitted, not from any objection to the name, but because it originally included seven, and perhaps eight, of my species, Nos. 20 to 28; and I know not to which species I ought to apply it: in this case, therefore, I adopt in every instance the earliest name given to each species after it was ascertained that Linneus had comprised more than one, under the comprehensive name of cristatum: a like number of species were subsequently comprised under the name of "Dilatatum," and again under that of "Spinulosum." Of these eight ferns it may truly be said that opinions will always differ; some authors divide them into three species; others into four; and there is no occasion whatever for any hostile feeling towards those who in this respect differ from ourselves: the only point absolutely requisite is to learn, thoroughly and perfectly, the object

intended by the name employed; and, just as among pigeons we soon gain a tolerably correct notion of what is meant by the terms "fantail," "pouter," "tumbler," &c., so in ferns it will be found extremely easy to learn what I mean by "Recurvum," "Multiflorum," "Callipteris," &c., and having learned this, then the long dissertations whether they are species or varieties will be understood, although very rarely found of much interest.

It will be observed that I have almost invariably confined myself to a single Latin name: I am aware that this is contrary to all practice, authors pluming themselves on the number and length of the Latin appellations they bestow on each species: no less than eighty-six Latin names have been assigned to Filix-femina and its varieties, and forty-seven to Scolopendrium and its varieties. These mentally athletic feats of name-making doubtless excite wonder and admiration amongst the gardeners for whom they are intended, but there is not the remotest probability of their ever being of the slightest use to any one else.

As regards what are called "generic" names, such

as Aspidium, Nephrodium, &c., it will soon be seen by any one who studies botanical works, that these names have no definite signification; thus the same group of species is called Dryopteris by Asa Gray in America, Polystichum by Roth in Germany, Lastrea by Babington in England, and Aspidium by Hooker in England. I have never met with a botanist really conversant with ferns who in conversation used either of these terms: it is the invariable plan to use the specific name by itself, as Recurvum, Scolopendrium, Ceterach, Trichomanes, Viride, &c., and no amount of "generic descriptions," as they are termed, is at all likely to interfere with this praiseworthy custom: the object of conversing on such subjects is to make ourselves understood, not to display the amount of our erudition; and the less of Latin or any other unfamiliar language we import into our conversation, the better will it be relished by all who truly and earnestly desire either to learn or to teach. Moreover, these so-called "genera" are purely and confessedly artificial; for instance, the genus Polypodium was first characterized by the seeds being arranged in circular masses on

the back of the frond; but this character being common to more than a thousand species, an improvement was suggested, namely, that the masses of seed in the true genus Polypodium ought to be naked, that is, uncovered by that filmy membranaceous scale to which has been applied the sounding and singular name of "indusium." Thus restricted the genus includes certain British Ferns which have not the slightest relationship to each other; such are Vulgare, Dryopteris and Alpestre; and these differ more essentially than any others that could be named. Eventually a more natural system will undoubtedly prevail, but at present all is artificial, unnatural and arbitrary.

Then, as regards the arrangement of species: it is impossible for the candid mind to dwell for a moment on the fact that Britain produces only about one-fourth part of the ferns already known as inhabiting the globe, without perceiving the impracticability of arranging that fractional part in anything like a connected series. Select one British species, the True Maidenhair, as an instance, and we shall find that there are at least a hundred species which

approach it more closely than any other species that occurs in Britain; therefore, assuming that two thousand ascertained ferns constitute a connected chain, it follows that in Britain a hundred links are wanting at that part of the chain where the True Maidenhair is placed. No wonder, then, that when we look at any list of ferns we are unable to understand the reason for placing the True Maidenhair and its next-door neighbour side by side. But there is still another mode of accounting for some of the monstrous gaps observable in our best-arranged series of ferns. The changes continually occurring in the condition of the earth's surface, render large tracts of land incapable of sustaining any longer certain plants which formerly concealed the soil beneath their luxuriant foliage: we know that thousands of species formerly existing, but now existing no longer as living things, are preserved for ever in the solid rock, on which their history is written by Nature's own hand. The hypothesis that Nature is compensating herself by new creations, or new developments, for the losses thus sustained is now very popular; but with the sober-minded it requires

the recommendation of proof. All our Floras tell a different tale: no links have been supplied to compensate for those that have perished. Whoever reads Nature aright will readily understand the difficulties under which those are labouring who endeavour to build up a system with such scanty materials. For my own arrangement I claim no merit: I should be most unwilling to assert its superiority over others.

Plants are grouped into four Provinces called Exogens, Endogens, Acrogens and Thallogens: the first and second of these Provinces consist entirely of flowering plants; the third and fourth, of those which are without flowers. Acrogens, though without flowers, have distinct roots, stems and leaves, and the two halves of the latter are generally symmetrical. Such are Ferns, and these characters at once distinguish them from Sea-weeds, Lichens or Fungi, which are properly designated "Thallogens." Acrogens are again divided by the structure of their leaves; they are either what botanists term vascular, that is, composed of bundles of vessels, or cellular, which means composed of simple cells; this division

need not be pursued further; it is sufficient to say that the vascular Acrogens are Ferns, and the cellular Acrogens, Mosses.

It next becomes desirable to consider the structure of Ferns, with a view to the intelligible designation of the several parts. In my descriptions I have endeavoured, as far as possible, to combine simplicity with uniformity: I have never used a technical or Latin word when I could find an English one that would answer the purpose; but there are occasions when it becomes absolutely necessary to use words that do not occur in our old dictionaries; and these are when we have occasion to speak of objects of which the compiler of the dictionary was totally ignorant, and it is thus with Ferns: in describing them with precision we are compelled to mention objects totally unknown to Dr. Johnson and the earlier lexicographers, although introduced into that invaluable work, "A Dictionary of the English Language, by Noah Webster, revised and enlarged by Chauncey A. Goodrich." In this, every term I have employed will be found, accompanied by an admirable explanation. But as many of my lady readers may

not possess that ponderous tome (1164 pages) I beg to offer a few brief explanations here, hoping the expert botanist will excuse what he may consider unnecessary repetition.

Every Fern has three principal parts, the roots, the stem, and the leaves: the roots are never large and woody, like the roots of trees, but are invariably slender and fibrous, and, what appears to have been unnoticed by all other writers, are in a great number of species, a portion of the frond: to make this more clear, I will here state that there are two great groups of dorsiferous ferns: in one of these groups the roots, as well as the fronds, spring separately from a prostrate creeping stem called a "rhizome," and in the other the leaves spring from the crown of a trunk-like stem called a "caudex" or "cormus," and one or two roots spring from the back of the stalk of each frond. Ferns of the first division are called "Rhyzophylls," those of the second division "Cormophylls." The common Polypody is an excellent example of the first division, the Male Fern an equally good illustration of the second. The roots always being fibrous are called indifferently

"roots," "rootlets," "radicles" and "fibres." This fact of the roots of a Fern springing from its fronds is extremely interesting, and has escaped the notice of all botanists. If we examine a Tree Fern, however lofty, we shall find that it has no real roots, or none that at all resemble the roots of a tree, which grow at the bottom of its trunk: the roots originate either singly or in pairs from the back of the stalk of each new frond, and extend gradually down the sides of the trunk towards the ground, which, in the majority of cases, they are destined never to reach. It is curious to see these fibrous roots apparently receiving nutriment from the decaying exterior of the trunk, and thus affording in appearance the paradoxical spectacle of a plant feeding on itself. If we accept this theory of the development of a Tree Fern, it follows, as a matter of course, that the trunk may be chopped off at the bottom, and the entire plant carried to a distant country, or even a voyage round the world, and then set up again in any suitable climate, without suffering any injury whatever, provided the upper or living extremity were so situated that its normal

conditions as to moisture, &c., were maintained. As a natural sequence, we might expect to find that after the base of the trunk had thoroughly decayed, the action of wind and other causes would be continually throwing down these Tree Ferns in a state of nature: and so it is; their prostrate trunks encumber the ground in all directions; the growing extremity often continuing to develope its convolute fronds, even when the trunk is prostrate on the earth.

The second portion of a fern has some analogy with the trunk of a tree; it is sometimes erect and trunk-like, as in the Tree Ferns, to which I have just been alluding; sometimes merely an almost globular mass placed erect in the earth; and sometimes a creeping, root-like stem, which either climbs trees and rocks in the manner of ivy, or creeps in a horizontal direction under ground, in the manner of what is called "couch-grass," sending up a leaf here and there to develope itself above the surface. I have already stated that it is called "caudex," "cormus," or "rhizome," according to its position and character; but in any state, and under any

form it may without impropriety be called the "caudex." The common Polypody is an example of this form of stem that may be found every day in the year, and in almost any locality: it climbs over rocks, stone walls, and trunks of trees, just in the same manner as ivy, and indeed attaching itself in the same way, by its fibrous roots. The beautiful Bristle Fern is another excellent example of this kind of caudex, as may be seen whenever this delightful fern is successfully cultivated. The other form of rhizomatous or root-like caudex is exemplified in the Common Brakes: it is always clothed with a velvety pubescence or coating of hair, and is invariably concealed beneath the ground. All our Spleenworts exhibit the "cormus" form of trunk, the crown whence the fronds are developed being invariably clothed with hair-like scales. The true trunk, or cormus proper, is strikingly illustrated in the Male Fern, and the Lady Ferns, each of which may be taken as a fair representative of a Tree Fern in miniature.

The third portion of a Fern is the frond: this is something like a deciduous branch: it cannot,

with strict propriety, be called a leaf, because it combines the characters of branch and leaf: this is not perhaps, at first thought, quite so apparent as when it comes to be considered carefully in all its bearings: take, for instance, the beautiful genus Lygodium, not a native of Britain: the frond of this genus, after appearing in the usually circinate or convolute form, climbs up the stems of the shrubs amongst which it grows, twining round and round in a spiral manner, just in the same way as the hop-plant on a pole; its stalk is tough, wiry and very durable, and from every part of this stalk arise palmate divisions or leaves, exactly like those of the various species of ivy. Now it would be very confusing, in the case of the hop or any other plant, to call the stalk and leaves by the same name; and it is so with Ferns; and it is on this account that the term "frond" has been substituted for "leaf," because the word "leaf," although expressing a great part of the truth, does not express the whole truth. Moreover, in a great many Ferns, the Flowering Fern for example, the divisions of the frond are deciduous, falling off in autumn, just like

the leaves of the sycamore or lilac, and leaving the stalk quite bare, like a branch stripped of its foliage.

The component parts of a frond have next to be considered; it consists of a stalk and a leafy portion; the stalk, however, is generally continued into the leafy part, and extends to its very tip. Botanists are not agreed on the names of these parts; some call the whole of the stalk the "stipes," others confine this term to the lower or naked part, which corresponds to the stalk of a vine-leaf, and where it enters the leaf it is called the "rachis." I have found it best to call the naked part by the simple term "stalk," and the remainder the "midrib"; these terms will be found of almost universal application, and I think that if we can achieve something like uniformity in the names of parts a great object is gained.

The stalk is generally clothed more or less thickly with scales, hair or down; and the general midrib or rachis, as well as the partial midribs, and the entire back of the frond, partake more or less of this natural clothing. In the genus Osmunda

the down is extremely soft and compact, like the finest cotton-wool, and it seems to have very little connexion with the stalk, falling off in large flakes, even before the frond has unfolded. This, however, is a very unusual character; the clothing of the stem more commonly consists of scales, some of which are very narrow and hair-like, while others are broad, flat, and of very considerable size; these adhere to the stalk until removed by some slight force.

The shape of the frond is usually described without reference to the stalk, and with regard only to what may be termed the circumscription or outline; this is always considered quite independently of the numerous finely-cut divisions, which give to a Fern such exquisite and feathery beauty. This outline or circumscription varies from the broad triangular or deltoid form which distinguishes the Common Brakes, to the simply linear or strap-shaped form so well known in the Hart's Tongue: the most usual form is almost exactly intermediate between these two, and is known as lanceolate, a term which Sir James Smith very aptly illustrates by the leaf of a tulip,

gradually becoming narrower towards each extremity: this form of frond is more or less the character of the Male Fern, the Lady Ferns, the Prickly Ferns, and most of that family of Ferns which the careless and superficial love to call "Dilatatums."

The cutting or dividing of the frond is a character which admits of more minute description: when there is no division at all the frond is called "entire," and of this the Hart's Tongue is the most familiar example: but when it is deeply notched along the edge, the notches going in almost to the midrib or mid-stem, it is called "pinnatifid"; of this the common Polypody is an example which you may find almost everywhere, and almost every day in the year. Going one step further, when the notches go quite to the midrib, and all the divisions are like distinct leaves, then the frond is said to be "pinnate," and the divisions are called "pinnæ": of this the Holly Fern furnishes an excellent example. But these simple characters of outline, these "entire," "pinnatifid" or "pinnate" forms are not so common as more divided forms: the pinnæ are often divided, and their divisions are called "pinnulæ" or "pinnules"; and

even these are again and again divided, but the divisions have not received any name of general application.

Lastly, we come to the fructification or seed: this is contained in little round cells or cases, commonly called "capsules," and these are often surrounded by a jointed ring which terminates in a short stalk; when ripe the capsule splits open, and its elastic ring, by a series of jerks, throws out the seeds. These capsules are also called "thecæ" and "sporangia," and are generally seated on the back of the frond in little clusters or masses, which are also called "sori," but I have carefully avoided these words, thinking the English terms "capsules" and "clusters" or "masses" better in all respects; more correct, more expressive, and more intelligible. These clusters or masses of capsules are often covered with a thin filmy scale called the "involucre" or "indusium"; and this has for a long time been used for the purpose of artificially dividing Ferns into groups; but for this purpose its form is too varied, and its presence too uncertain, to be of any use whatever: the mode in which the masses of seed

are attached to the vein which produces them is of far more importance; that is, whether on the back or side of the vein: in all the Spleenworts it has this latter character. But it is time to conclude, and I must refer to the Glossary which immediately follows for any further information that may be required, as well as for an alphabetical summary of these explanations. And here, I have great pleasure in acknowledging my indebtedness to Sir J. E. Smith's invaluable 'Grammar of Botany,' for many of the explanations adopted in the Glossary: in some instances these are copied *verbatim*, as shown by the inverted commas; in others the meaning rather than the words has been adopted, but even in these instances I am very desirous of acknowledging my great obligation to the works of our illustrious British botanist.

In conclusion, it becomes necessary to notice, just to show that I am aware of, the Fern-Books that have sprung up around mine, like mushrooms around the parent plant: I have read them all; I have thought this a duty, and have performed it: and I unhesitatingly pronounce, with the German critic,

that in all the mass of Fern-literature that owes its existence to my various editions, "What is new is not true: and what is true is not new." It is, however, a great satisfaction to me to believe that the study, originated by myself, has been a source of profit to others, and that their emulative industry has conferred no injury on myself. This final edition, like those which have preceded it, will doubtless raise up its host of imitators: to all such I most cordially wish success. But it is a still greater satisfaction to me to know, that by introducing this new study, I have afforded pleasure to thousands and pain to none: wherever I go there are Ferneries in the open garden, in the green-house or the dwelling-house, and "Newman's Ferns," albeit sometimes under another name, has become a household book.

GLOSSARY

OF

TERMS EMPLOYED.

Abnormal, different from the ordinary or natural form, usually called normal.

Adnate, attached to a stem, without any stem of its own.

Anomalous, irregular, deviating from the usual or habitual form or manner.

Apex, tip.

Appressed, pressed against the stalk.

Articulated, jointed.

Articulation, a joint.

Attenuated, gradually narrowing to a point.

Auricled, furnished at the base with a leaflet, which, in some instances, is very distinct and separate, at other times united to the pinna or pinnule; some leaves are auricled on both sides at the base.

Bifid, having two points.

Capillary, hair-like.

Capsule, a cell containing seeds.

Caudex, or stem, that part in all ferns from which the fronds emanate, "the body of the root above-ground and bare becoming, as it were, a stem."

Chaffy, partially covered with thin chaff-like scales.

Circinate, curled inwards in gradually decreasing circles, like the spring of a watch.

Concolorous, alike in colour throughout.
Confluent, uniting together.
Congener, a near ally.
Convolute, rolled over at the edges.
Crenate, or Crenulate, when the teeth or serratures are rounded, and not directed towards either end of the leaf, as in ground-ivy.
Cuticle, "Every living plant is covered with a skin or membrane called the cuticle;" this cuticle covers every part of the plant.

Deciduous, falling off, like the leaves of lilac, sycamore, mulberry, &c., &c.
Decurrent, "running down the stem or stalk in a leafy border or wing."
Deflexed and Deflected, bent or curved downwards.
Deltoid, triangular.
Diagnostic, a character by which two objects are distinguishable.

Eglandulose, without glands.
Elongate-lanceolate, longer and narrower than lanceolate.
Enduring, lasting or remaining, not fading or falling off quickly like the petals of flowers.
Evanescent, or vanishing, any character that lasts for a short time and then disappears.

Fertile, bearing fruit or seeds.
Fibrillæ, extremely small fibres which clothe the rootlets of the Bristle Fern.
Flexuous, waved.
Friable, crumbling to pieces in the hand.
Frond, "In this the stalk, leaf and fructification are united, or, in other words, the flowers and fruit are produced from the leaf itself, as in ferns."

Gibbous, apparently swollen.
Glabrous, smooth, without any hairiness.
Gland, "is defined by Linneus as a little tumour discharging a fluid; such are abundant on the stalk and calyx of the Moss Rose."
Glandular, bearing such glands.
Glaucous, of a blue-green colour.

Imbricated, laid over one another, like tiles on the roof of a house.
Involucre, a bleached membranous scale, which frequently covers the masses of seed on the back of a fern frond.

Lanceolate, "narrow and tapering at each end, like the leaf of a tulip."
Leaflet, a little leaf, applied in Botany to a division of a leaf. Synonymous with Pinnule.
Linear, "narrow, with parallel sides, as in most grasses."
Lobe, a rounded division or segment; hence *lobed*, divided into rounded segments.

Membranous, very thin, like a mere membrane.
Median, in the middle.
Midrib, the stalks which run into the frond; the frond itself, as well as each of its divisions, has very commonly a midrib.

Obovate, short egg-shaped.
Obtuse, blunt.
Ovate, "the shape of an egg cut lengthwise, the base being rounded, and broader than the extremity."
Ovate-lanceolate, between ovate and lanceolate; a tulip-leaf shorter and broader than usual is ovate-lanceolate.

Pellucid, almost transparent.
Persistent, lasting, like a holly-leaf, as contrasted with deciduous, like a lilac-leaf.
Petiole, the little stalk on which pinnules or pinnæ are supported: "the foot-stalk or leaf-stalk."
Pilose, hairy.
Pinnæ: the primary divisions of a leaf: when a leaf is divided, like that of the Mountain Ash, the divisions are pinnæ.
Pinnate, divided like the leaf of the Mountain Ash.
Pinnatifid, almost pinnate; when a leaf is deeply divided, but not quite to the midrib.
Pinnules, the secondary divisions of a leaf: when a leaf is twice divided, like those of the Acacias and Mimosas, the divisions of the first series are pinnæ, and the divisions of the pinnæ, pinnules.
Prostrate, lying on the growth.
Pubescent, slightly hairy or downy.

Quadrate, almost square.

Radicle, small root.
Rachis, the main midrib of a frond.
Ramify, to branch.
Reniform, shaped like a kidney.
Reticulated, when the veins interlace each other like net-work.
Rudimentary, used to express that the part so described is in an imperfect or undeveloped state.

Salient, projecting, prominent.
Segment, a division of the frond.
Serrate, "when the teeth are sharp and resemble those of a saw, pointing towards the tip of the leaf."
Serratures, the teeth of a saw-like edge.
Sessile, having no stalk or stem.

Spathe, "sheath, a covering which bursts longitudinally. This is exemplified in the snowdrop."
Sphagnum, a genus of mosses which usually grows with the roots in water.
Spined or Spinous, terminating in a sharp point.
Stolon, the running horizontal stem of mint, couch-grass and many other plants.
Striate, marked with fine parallel lines.
Submarginal, almost marginal, near but not quite on the margin.

Tomentose, "downy, very soft to the touch."
Trifid, having three points.

Ultimate, the last or smallest division.

Vein, the frame-work on which the leaf is supported; held up to the light they appear somewhat transparent.
Venation, the order or formula in which the veins are placed.
Vernation, the first development of the young frond.
Vertical, upright, or perpendicular to the horizon.

Wing, a dilated membranous appendage running along both sides of the stalk.

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BRITISH FERNS.

1. TRUE MAIDENHAIR. CAPILLUS VENERIS.

Adiantum Capillus Veneris, *Linneus.* *B. F.* 1.

The caudex is black, scaly and slowly creeping: the fronds make their appearance in May, are fully grown in July and remain green until winter: the stalk is smooth, black and shining; the leafy part of the frond is very irregular, and consists of a number of leaf-like divisions, which are generally rather fan-shaped or wedge-shaped, but they are very diversified: these divisions or pinnules are of a delicious green colour, and each stands on the most delicately slender footstalk, more like a hair than the stem or petiole which usually supports a leaf: when these divisions or pinnules are barren their outer margin is notched like a saw, but they are very commonly fertile, and then are divided into lobes; each lobe is blanched and loses its sweet green colour, and is folded over; and on the folded part are the small round clusters of seeds, perfectly concealed from sight, except when

Mo. Bot. Garden, 1897.

the margin of the leaf is unfolded: the pinnules have no mid-vein, but the veins issue from the footstalk, at first few in number, and continually dividing run in parallel lines to near the margin, and each at its extremity bears the cluster of seeds I have already described.

Every plant seems to have what may be called its metropolis, whence it spreads more or less to other countries. The True Maidenhair is widely distributed, but its metropolis seems to be in the Atlantic Islands, where the very atmosphere is so impregnated with its seeds that every moist stone soon becomes covered with it as with a robe of delicious green: from these beautiful islands the fern seems to spread to the sea-coast of Africa and Europe, growing by the Mediterranean in abundance, and more sparingly on the western coasts of Spain, Portugal and France. In Great Britain it makes its appearance on the coast of Cornwall, at Carclew, the seat of Sir C. Lemon; at St. Ives; again between St. Ives and Hayle; and in a sea-cave called Carrick Gladden: in Devonshire it occurs both on the south and north coast; on the south coast at Brixham, and at Mewstone Bay near Berry Head; on the north coast at Rillidge Point; in White Pebble Bay; and in three or four other localities near Ilfracombe: on the opposite side of the Bristol Channel it is found on rocks at Dunraven, and on the cliffs of lias at the eastern extremity of the county: again in the

Isle of Man, in Glen Meay and between Douglas and Peel; and in Scotland by the Carron, in Kincardineshire. On the western coast of Ireland it is most abundant on the coast of Clare from Ballyvaughan to Cremlin Point; and in the south isles of Arran; also sparingly on the Cahir Conree Mountain, near Tralee; and near Roundstone, in Connemara, on the banks of Lough Bulard.

In cultivation it requires a green-house or other covering of glass, our English atmosphere being too dry for it to thrive. I find a mixture of small pieces of limestone, silver sand, sifted peat earth, and light friable loam suits it well; suspended in the husk of a cocoa-nut it grows very luxuriantly, and forms a beautiful mass of the most vivid and delightful green; if in a flower-pot the lower half of the pot should be filled with small pieces of pot, or limestone broken very fine and mixed with a few lumps of charcoal, and the bottom of the pot may stand in a saucer of water.

2. ANNUAL MAIDENHAIR. Leptophylla.

Gymnogramma leptophylla, *Desvaux*. *B. F.* 12.

The little tufted caudex of this pretty fern is annual, lasting only during the summer and autumn: the fronds are very few in number, stiff and erect, and seldom more than three inches high; the stalk is

shorter than the leafy part of the frond, rather stout, smooth and of a pale brown colour; the shape of the frond is very varied, but the more common shape is something approaching to oval, but pointed at the tip; it is very much divided, that is pinnate, the pinnæ being stalked and again pinnate, the pinnules again divided, and the divisions notched at the extremity, a forked vein running into each; after the fork the veins are always curved and are crowded with seed from the fork to the end: these clusters of seeds at first appear linear, but soon expand and at last cover the entire back of the frond. In addition to these principal fronds there are others shorter, more membranous, and consisting merely of three or four fan-shaped divisions, which are either barren or very sparingly seeded.

This is a common fern in the Atlantic Islands and also on the shores of the Mediterranean, and in many inland localities of Europe, particularly Spain, Portugal, France, Italy and Greece. The only claim to its station among British Ferns is its having been discovered, in 1852, in Jersey, by a lady whose name has not appeared in print; this lady communicated her discovery to my friend Mr. Henry Hagen, who kindly sent me specimens, when I at once verified the name assigned to it in doubt. I had the pleasure of communicating this interesting discovery to the botanical public of Britain in the 'Phytologist' for

March, 1853. I was almost overwhelmed with communications upon the same subject during the following few weeks, and in May I summed up the information in the following words: — "Numerous communications from Jersey represent Gymnogramma leptophylla as widely distributed in that island, growing on the banks of exposed lanes having a southern aspect, more especially in those localities in which the moistened soil induces the growth of Marchantia, in the company of which plant it appears particularly to flourish; it also occurs, but not so frequently, growing in moss. The principal localities are near St. Haule, near St. Aubin's, and in several places near St. Laurence. In one spot near the last-named place it grows plentifully for a considerable distance along a hedge-bank, extending as far as the bank is exposed, but ceasing exactly where the lane is shaded by trees." —*Phytol.* iv. 1094. Mr. Ward, the next year, visited the localities, and gave me some interesting information: he says, "I have found this little fern on a bank with a south-western aspect, not densely shaded by trees, as in the case of most of the Jersey lanes, but protected from the direct rays of the sun by the dwarf vegetation of the bank, which, from the constant oozing of a small stream, is sufficiently damp for the growth of Marchantia, with here and there a patch of Fissidens bryoides."

This interesting little fern must be cultivated under

a bell-glass in a mixture of light friable loam and sand: mosses must be allowed to grow in company. It seeds very freely, and though some of the seeds may lay dormant for years there will be a pretty constant succession of plants.

3. HARD FERN. Spicant.

Blechnum spicant, *Withering*. *B. F.* 17.

The caudex of this common fern is tufted and its crown hairy. The fronds are of two kinds, fertile and barren. The fertile frond is erect, linear, simply pinnatifid and pointed at the tip; the lower half of the frond is dark purple, smooth, shining and naked, but furnished on each side with some rudimentary pinnæ, scarcely observable without a close inspection, and having, towards the base, a few scattered, long, narrow, pointed scales; the upper half of the frond has linear, narrow pinnæ, rounded at the apex, convolute at the sides, and densely and completely covered with seed on the under side. The barren fronds are much shorter than the fertile, their position generally horizontal or prostrate on the surface of the frond, lanceolate or strap-shaped and pinnatifid; the pinnæ adnate, sessile, crowded, entire and rounded at the tips; the stalk occupies about a sixth of the length of the frond; it is naked, dark brown and slightly scaly. The fertile

fronds having shed their seed disappear at the approach of winter; the barren fronds, on the contrary, are persistent and evergreen.

The hard fern is very common in Great Britain and Ireland, more particularly on clayey or sandy soils: I never recollect having found it on chalk; it occurs in woods, on heaths and commons and in waste places.

In cultivation it requires no particular care, but does not flourish in a London atmosphere, and under a hand-glass or in a green-house, where ventilation is imperfect and the atmosphere damp, is very apt to decay: the ordinary mixture of peat, loam and sand suits it, but it will grow well in loam only or even in a stiff clay.

4. COMMON BRAKES. AQUILINA.

FERN, BRACKEN IN SCOTLAND.

Pteris aquilina, *Linneus*. *B. F.* 23.

This is the commonest of all our ferns, and the one to which the name "fern" is emphatically applied: it is supposed to inhabit almost the whole world. The caudex is about the thickness of a goose-quill, densely covered with hairy pile, like coarse plush, and entirely subterranean, and extending itself rapidly in every direction. Wherever this fern has been growing

unmolested for many years the soil becomes filled with matted masses of its underground stem, so that acres of ground in parks, on commons and in woods are often covered with a dense forest of fern, sometimes so high as to hide the deer, which appear to delight in the shelter it affords. The young fronds, which, like the caudex, are covered with a dense and compact coating of hair, emerge at unequal intervals from every part of the caudex in a perfectly erect position, and at right angles with the caudex; the summit of the young frond being folded like a shepherd's crook, and not rolled or circinate, like an Ionic volute, as is generally the case with our ferns; at this stage it is very susceptible of cold, and is cut down by the late frosts which so often occur in the spring. There is something well worth observing in the rapid development of the leafy portion of the frond; at first it is a mere hairy sprout, exhibiting nothing leaf-like, but in a few days we find it has increased and unfolded with a rapidity of growth that appears miraculous, and eventually attains a magnitude unequalled by any other British fern, except Osmunda regalis. The form of the frond is nearly triangular, the base being the shortest of the three sides; the stalk is rather more than half the length of the frond, green and rather pilose; the pinnæ are pinnate, the pinnules pinnatifid, the lobes generally rounded and entire, but sometimes again divided; the first superior pinnule on each

pinna is usually very small, and, as it were, rudimentary only. The fronds are almost invariably fertile, but all parts of the frond are not equally so: in seedling plants, which occasionally grow in caves, fissures in rocks or on stone walls, they are smaller, tender, delicate and barren; the margins of the lobes of the pinnules are then flattened and notched. That part of the stalk below the ground is of a dark brown colour, like the caudex, which it closely resembles in general appearance; it is also considerably more robust than that above ground. When cut through in an oblique direction, the section exhibits a regular figure, by many thought to represent an oak, by others compared to a spread eagle, and by the Scotch, according to Dr. Johnson, to the impression of the "de'il's foot"; of which comparisons that to an oak is perhaps the least fanciful: I am incompetent to express any opinion as to the last-mentioned, not having seen the impression of the foot in question.

In England, Scotland, Wales and Ireland, this fern grows almost everywhere, except on the chalk.

I need give no instructions as to cultivating the Common Brakes; growing freely in every green-house, and in every garden, too freely indeed, often becoming a perfect nuisance; nevertheless its appearance as a seedling in the green-house is often very beautiful, and is extremely puzzling to a beginner, its delicate texture and tender green colour differing

widely from its ordinary characters on our waste lands.

5. PARSLEY FERN. Crispus.

ROCK BRAKES.

Allosorus crispus, *Bernardi.* *B. F.* 35, 39.

Caudex procumbent, extending itself very slowly in a horizontal direction, and producing a succession of fronds from its crown: this procumbent or horizontal position appears rather the effect of age and the consequent want of power to maintain itself in an erect position, rather than of any tendency to a creeping habit. The fronds unfold in May and June, and disappear at the commencement of winter, being apparently incapable of bearing frost: they are of a vivid green colour, and of two kinds, barren and fertile, both of them indistinctly triangular in form and very much divided, being composed of a number of stalked leaflets; the pinnæ, pinnules and ultimate leaflets are arranged alternately; the stalk is slender, smooth, pale green, and generally considerably longer than the leafy portion of the frond; the ultimate divisions of the fertile frond are oval, and stand on distinct petioles; their margins are inflated or convolute, membranaceous and bleached; the midvein in each is flexuous and bears eight or ten lateral veins placed alternately; these are divided shortly after leaving the midvein, and each bears a

nearly circular cluster of seeds at, or very near, its extremity, which does not quite reach the membranous margin. The ultimate divisions are frequently auricled at the base on one side only. The character of the barren frond is very various: its appearance is generally crowded and crisped, like the leaves of parsley, whence the name of Parsley Fern, very frequently applied to this species; when carefully examined, however, its ultimate divisions or leaflets very closely correspond with those of the fertile frond.

This pretty little fern is local in Britain, and almost confined to the north of the Mersey; a few roots have been found at Challicombe, near Simmon's Bath, in Somersetshire; again, on the Malvern Hills, in Herefordshire; on Chinley Hills, in Derbyshire; on the Titterstone Clee, in Shropshire; on Snowdon and Cader Idris, in North Wales, and also in Glamorganshire; in all these localities it maintains a most precarious existence: in Yorkshire, Lancashire, Westmoreland, Cumberland and Durham, on the contrary, it is abundant in many localities, and in what is emphatically called the Lake District it makes itself particularly at home. In Scotland it is less abundant than among the English Lakes, but nevertheless is very frequently seen ornamenting the stone walls with its lively foliage; indeed it seems to prefer stone walls at a moderate elevation to the more exposed summits of the Scotch hills! In Ireland it is a fern of very

great rarity; a very few roots have been found on Slieve Bignian, in the County Down; a few others within the liberties of Carrickfergus, in the County Antrim; and a single root on Carlingford Mountain, in the County Louth.

In cultivation, it grows best in peaty bog earth, without any admixture of loam, and great care should be taken that no water stands about the roots, as this is sure to prove fatal.

6. POLYPODY. Polypodium vulgare.

Polypodium vulgare, *Linneus*. *B. F.* 41, 43, 45.

The caudex is about the substance of a goose-quill, and entirely covered with a dense, brown, pilose cuticle, which dries up and peels off after one year's growth, leaving the caudex smooth; it is decidedly creeping, making an annual growth of considerable extent. The young fronds are thrown out in May and June, and never issue from the growing point of the caudex, but from any part of its surface; they arrive at maturity early in September, and retain their full vigour until the fronds of the succeeding year make their appearance. The young fronds are generally erect at first, but droop by degrees, and are always pendant when mature. The stalk is green, and is about half the length of the entire frond; the leafy

portion is strap-shaped, pinnatifid and pointed at the tip; the pinnæ are nearly linear and rounded at the tip; their edges are more or less serrated. The fronds are almost invariably fertile, and the clusters of seeds are confined to the upper part of each: when barren the imperfection arises from uncongenial situation, and the plant cannot be considered in a perfectly natural and healthy state; the lateral veins in the pinnules are alternate, and each is divided into four branches, three of which extend nearly to the edge of the pinnule, and are thickened at the end; the fourth is directed forwards, and at its termination, which is equally distant from the midvein and the edge of the pinnule, it bears a circular cluster of seeds.

In Great Britain and Ireland this is one of our most familiar ferns: it seems to affect the companionship of man, establishing itself on the garden-wall, on the roofs of cottages and pigsties; it surrounds with a verdant crown the pollard-willows that fringe our canals and ditches, our mill-streams and horse-ponds: it decorates with its gay green the old hornbeams in Epping Forest, where its vigorous masses of caudices have probably flourished for ages: it flourishes most where there is an abundant supply of decaying vegetable matter: its presence on forest trees may be taken as a sure symptom of incipient decay.

To cultivate such a plant it can only be necessary to imitate its natural conditions: plant it among

stones, especially soft sand-stones, and fill up the interstices with a mixture of leaf-mould and sand: it cannot be too freely exposed to the weather, except in London, where the smoky atmosphere appears very distasteful.

7. BEECH FERN. PHEGOPTERIS.

Polypodium Phegopteris, *Linneus*. *B. F.* 49.

The caudex of the Beech Fern is stolon-like, wiry, tough and creeping; the fronds are thrown up in May, rising on erect, succulent and very brittle stems, clothed with a few pale scattered scales; they unfold with wonderful rapidity, attain perfection in July, and are destroyed by the early frosts on the approach of winter. The position of the frond is at first nearly erect, subsequently horizontal, and finally pendulous; the leafy portion varies from three to nine inches in length, and the stalk is sometimes double that length. The form of the leafy portion is triangular and very pointed at the tip; it is pinnate, the pinnæ being pinnatifid, nearly parallel at the sides, and very sharp at the tip; the first or lowest pair of pinnæ are turned backwards and sideways, so as not to stand on the same plane as the others; they are sessile and united to the main stalk by the midrib only; the remaining pinnæ point forwards, they are

united to the main stem by the entire breadth of their base, and, with the exception of the second and third pairs, are also confluent at the base: the fronds, including the stalk, are pale green and slightly hairy: they are always fertile when of full size. The lateral veins of the pinnules are few in number, alternate, almost invariably undivided, and extend to the edge of the pinnule, each bearing a circular cluster of seeds near the edge of the pinnule, so that together they form a nearly marginal series.

The Beech Fern, as regards Great Britain, may be considered a northern species; the localities in the South of England are few and widely separated, namely, at Tintagel, in Cornwall; on Dartmoor, at Sheep's Tor, Cock's Tor, near Ilfracombe, and at Becky Falls, in Devonshire; Forest Row and near Balcombe, in Sussex; in the Forest of Dean, in Gloucestershire; and at Amstrey Quarry, in Herefordshire, most abundantly; a little further northward, on the Titterstone Clee and near Ludlow, in Shropshire; profusely on limestone rocks in Derbyshire; at Ridge Hill and Madely Manor, in Staffordshire; and at Mow Cop and near Werneth, in Cheshire. In Lancashire, Westmoreland, Yorkshire, &c., the localities are too numerous to mention; so also in Scotland and North Wales: it has been observed in the Isle of Man, and very sparingly in a few stations in Ireland, *viz.*, banks of Lough Eske, in the County Donegal: banks of the

Glenarve river, in the County Antrim: in Glen Ness, in Londonderry; on Slieve Bignian, near Slieve Croob, on the Black Mountain, and about Tollymore Park, all in the county Down; and on Carlingford Mountain, in the county Louth; on Garoon Mountain, Letterfrank, in Connemara; at Muckross, in Kerry; and at Powerscourt Waterfall, in Wicklow. In Great Britain it seems particularly to affect the neighbourhood of waterfalls, and to delight in their spray; and I really know of nothing more beautiful than a little forest of the Beech Fern waving its fronds from the perpendicular face of some limestone rock, constantly dripping with the misty moisture of a cascade: in such situations its creeping caudex will wander in all directions among the luxuriant mosses, and its fronds will attain a magnitude and a grace that no cultivation can successfully emulate. On the Continent it occurs everywhere from the North Cape to the Mediterranean, if the locality be adapted to its love of moisture.

To cultivate the Beech Fern successfully in pots, the following plan must be adopted:—Fill a large flower-pot to the height of three inches with charcoal broken into small lumps; on this arrange some Sphagnum, and cover it with peat earth having a slight admixture of well-decayed leaf-mould and sand; on this arrange the caudices of the fern, and cover them with the same mixture. The pot should stand in a

large feeder kept constantly full of water. Planted on rock-work and exposed to wind and sun it soon looks shabby and unsightly; I therefore recommend that it be kept constantly under glass, thus securing a greater degree of atmospheric moisture than can be attained in an ordinary garden.

8. OAK FERN. Dryopteris.

Polypodium Dryopteris, *Linneus*. *B. F.* 57.

The caudex of the Oak Fern is stolon-like, black, wiry and extensively creeping, often, when long established, forming a dense matted mass. The young fronds make their appearance in March and April, each at first resembling three little balls on wires, presenting a very curious and most characteristic distinction: these three balls gradually unfold and display the triple character of the frond. The fronds soon arrive at maturity, and are early destroyed: I have found them loaded with ripe seed as early as June, and before winter they have entirely disappeared. The stalk is very slender, of a dark purple colour, and shining; it is not unfrequently twice as long as the leafy portion of the frond; it has invariably a few small scattered scales towards the base. The leafy portion of the frond is triple, or composed of three

triangular portions, each of which has a short but very distinct naked foot-stalk: these three are united to the main or principal stalk at an obtuse angle. Each division of the frond is pinnate, and the pinnæ are opposite, pinnate at the base, pinnatifid towards the centre, and terminating in a somewhat obtuse point: the basal pinnules are sessile and of nearly equal size, so that the four, occurring at each union of the pinnules with the main stem, form a cross. The midvein of each pinnule or ultimate division is waved, and the lateral veins are alternate and mostly simple; each terminates at the edge and generally bears a circular cluster of dark brown seeds near its extremity; in some specimens these clusters are so crowded as to form a continuous marginal line; in others they are scattered and distant. The green colour of this fern is most vivid and beautiful, in this respect surpassing every species with which I am acquainted; when the plant is matured and of full growth they are always fertile.

This interesting little fern is common on the continent of Europe, and has been recorded as occurring in every country except Greece and Turkey. In the north-western counties of England, in North Wales, and in Scotland, it is quite common, but from the southern and eastern counties of England, and also from Ireland, it is almost entirely absent. I will mention a few southern and midland English localities.

Rocky places on the Mendip Hills, in Somersetshire; in Gloucestershire, in the Forest of Dean, south-east of the rocks of New Weir, on the Wye, by a path through the woods towards Staunton; in Worcestershire, on the Malvern Hills, in a stony ravine between the north and end hills, north of Great Malvern; in Herefordshire, in Mr. Knight's beautiful grounds at Downton, in Amestrey Quarry, in Shobden Hill Woods and Penyard, near Ross, where its habit is very delicate, and very little fruit is produced; in Shropshire, on the Hoar Edge and Titterstone Clee. In Ireland a single plant has been found on Knocklayd, in the county Antrim.

This is an extremely beautiful fern in cultivation, and flourishes on rock-work if supplied with a light and moist soil which its creeping caudex can readily penetrate: this should be composed of bog earth, leaf-mould and sand. Exposure to the sun rapidly changes the colour of the leaves, and causes the divisions to assume a convolute form; but if shaded by trees, which can readily be accomplished, a patch of the most exquisitely delicate and lovely green may be preserved throughout the summer months, the production of young fronds continuing as late as September. In flower-pots it is not so readily cultivated as in the open air, but still where an atmosphere free from impurities cannot possibly be obtained, and this is certainly the case in the neighbourhood of London,

its cultivation in pots and under glass must be resorted to.

9. SMITH'S FERN. Robertianum.

Polypodium robertianum, *Hoffman. B. F.* 63.
Polypodium calcareum, *Sir J. E. Smith.*

The caudex is dark brown and creeping; the fronds make their appearance in May, and both in their habit and their mode of unfolding differ from those of the Oak Fern: they never exhibit that appearance of three little balls on wires which I have mentioned as such an excellent characteristic of the Oak Fern; but all the pinnules before unfolding appear somewhat globular, and the first pair of pinnæ differ from the second scarcely at all except in size. The stalk is much thicker and more succulent than in the Oak Fern, and rather more scaly; both the stalk and leafy portion of the frond are of a dull green, having no similarity whatever to the exquisite colour of the Oak Fern. The frond attains its full development in July, and matures its seed in August: its form when fully expanded is triangular, the base being shorter than the sides and altogether not unlike that of the Common Brakes: the pinnæ are opposite; the first pair have always a short naked footstalk; the second pair have frequently, but not invariably, a similar footstalk; and

the naked stalk of the first pair of pinnæ is always shorter and rather more slender than the main stalk between the first and second pair; the pinnæ are pinnate, the pinnules deeply pinnatifid: all parts of the frond are covered with stalked glands, which give it a downy or tomentose appearance, a clammy or sticky feel when touched, and a very strong and peculiar smell, which has been compared to that of the Herb Robert Geranium, a peculiarity from which the name is derived.

Not uncommon on limestone soils in Somersetshire, Wiltshire, Oxfordshire, Gloucestershire, Derbyshire, Lancashire, Yorkshire, Durham, Westmoreland and Cumberland; it also occurs at Llanferris, in Denbighshire, and at Merthyr Tydvil, in South Wales. I have received one specimen from Scotland, but none from Ireland. On the Continent so many botanists have combined this with the preceding that it is difficult to give any definite idea of its geographical range. I do not, however, entertain the least doubt that it is generally distributed in limestone districts.

Robertianum grows freely in the ordinary soil of gardens, but seems peculiarly to enjoy a plentiful admixture of limestone broken small; of a constitution entirely different from Dryopteris, it prefers sun to shade, and will thrive in the most exposed situations: in the green-house it should be planted in a seed-pan containing a mixture of small pieces of limestone,

crumbled and sifted mortar from old walls, and light friable loam: the pan being partially filled with this mixture, the creeping caudex should be carefully arranged on the surface, and then covered with the mixture to the depth of an inch: the pan thus prepared should be placed in the most airy and exposed part of the green-house, and no shelter of any kind placed over or around the fern.

10. WILSON'S FERN. MYRRHIDIFOLIUM.

Polypodium Myrrhidifolium, *Villars.*
Polypodium montanum, *Link.* *B. F.* 97.

(*Note.*—When I had the pleasure of adding this species to the British Flora, I adopted the name assigned to it by Link, Koch, Presl and Fries, and in this I have been followed by all English authors; but I have since found that it was first described by Villars under the name of Polypodium Myrrhidifolium, and also that the name of Montanum given it by Allioni had been assigned to another and very different fern by Vogel eight years previously: on these grounds the name of Myrrhidifolium must be restored to the present species, and that of Montanum to the species for which the later name of Oreopteris has been very generally adopted: the principle of restoring prior names is now almost universal in Zoology: I can only

regret it is so frequently disregarded in the sister Science.)

The caudex of this little fern is brown, stolon-like, and creeps very extensively among moss on the ledge of rocks in those mountain ravines where it occurs: in such situations it is almost constantly wet from the percolation of water. From this creeping caudex the fronds rise at irregular intervals, and not unfrequently in pairs; each has a slender erect stalk, which is longer than the leafy portion of the frond; it has a few nearly transparent pointed scales scattered near the base, where it is of a dark purplish brown, but green at the upper part: the leafy part of the frond is almost horizontal, being elbowed at its junction with the stalk; it is triangular in form and pinnate; the first or lowest pair of pinnæ are nearly opposite, and very much larger than the others, indeed nearly equalling in size all the rest of the frond; these lower pinnæ are pinnate, and their pinnules are also pinnate, the remaining pinnæ becoming gradually alternate: the first inferior pinnule of the lowest pair of pinnæ is very much larger and more divided than the first superior pinnule of the same pair; this disproportion between opposite pinnules decreases gradually until at the tip of the pinna the corresponding pinnules closely assimilate in size: the lateral veins in the ultimate divisions are alternate, each generally terminating in a notch between two

points; the clusters of seed are seated on these veins, and are nearly circular; when young they are often partially covered by an involucre, which is attached behind them, and bends forward over them; this involucre is very various in size, often entirely wanting; its free edge is jagged and uneven: it is soon altogether lost, and the clusters of seeds increase greatly in size; each, however, retains its individuality, and they never seem to become perfectly confluent.

Found by Mr. Wilson, of Warrington, on Ben Lawers, in 1836, and subsequently in other neighbouring localities by the late Mr. Borrer, by Mr. Westcombe and Mr. Maw. I had the pleasure of first adding it to the British Flora in 1844. It has not been observed in any other county of Great Britain or Ireland, but occurs freely on the Continent of Europe.

To cultivate this fern successfully a small quantity of Sphagnum and charcoal should be spread over the bottom of a common seed-pan: this should be covered to a depth of two inches with a mixture of thin laminæ of freestone or mica schist, sandy peat, clean sand, and thoroughly decayed leaf-mould; the last in small quantities: arrange the caudex on this, and cover it with more of the mixture; place the pan in a cool green-house out of the reach of sunshine: in summer, while the fronds continue to be developed, cover the pan with a bell-glass, in order to secure

a moist atmosphere; but before winter remove the glass and expose the fern to the weather, watering it daily, except during frost and snow.

11. RAY'S WOODSIA. Woodsia Ilvensis.

Woodsia Ilvensis, *Brown*. *B. F.* 71, 73.

The caudex is thick and tufted, and lasts many years: the stalk is very distinctly jointed at a distance of three-quarters of an inch from its junction with the caudex; the articulation is swollen, and very obvious to the naked eye when the frond is mature; at this point separation takes place, the frond falling off like a deciduous leaf, the basal portion of its stalk adhering to the caudex. The stalk above this point is clothed with lanceolate scales and glittering articulated hairs. The vernation of this fern usually begins about the middle of March; it then throws up a tuft of elongated "shepherd's crook-formed" fronds, which are densely covered beneath with light-coloured, chaffy and hairy scales, and which exhibit no appearance whatever of fructification, even until they have attained a considerable degree of maturity. The frond is lanceolate and pinnate: the pinnæ are in pairs, and generally opposite at the base of the frond, but becoming alternate towards the tip; they are sessile, oblong, obtuse, deeply lobed, and in some specimens pinnatifid,

in which case the lobes are slightly notched; the upper surface of the frond appears smooth to the naked eye, but under a lens of high power a few long bristle-like scales are observable, all of them pointing outwards; the under surface is pubescent, and, with the aid of a lens, this pubescence is found to consist, *first*, of very long, pointed, narrow scales, which are more particularly abundant about the midrib; *secondly*, of glittering and jointed hairs, which are scattered over nearly the entire surface; and, *thirdly*, of the capillary segments of the involucres, which are also glittering and jointed. The seeds are placed in circular clusters near the margins of the lobes or pinnules; they are frequently concealed by the pubescence already described. The length of frond is generally less than four inches.

Although so many localities for Woodsia Ilvensis have been published it still remains one of our very rarest British ferns. I am only acquainted with one English locality, namely, at the foot of basaltic rocks on the Durham side of the river Tees, about two hundred yards below Caldron Snout. One Welsh county, Caernarvonshire, has also produced it; it grows on rocks near a little lake called Llyn-y-Cwn, or the Dog's Lake, on the ascent of Glyder Vawr: as many as a hundred plants still exist here, but are inaccessible without a ladder: there are also a few plants on rocks of a peculiar character resembling

limestone, which crop out on the Glyder, or left-hand side of the Pass of Llanberis, looking towards Capel Cerig. In Scotland it occurs on the Clova Mountains, in Forfarshire, and on steep crumbling rocks amongst hills dividing the counties of Dumfries and Peebles, and on the farm of Corehead, about four miles north of the town of Moffat, and again six miles eastward of this in a ravine near Loch Skene. It has not been found in Ireland. In writing of European localities I can only say that its *name* is recorded (I am not certain whether this plant or the following is the one really observed) as a native of Denmark, Germany, Hungary, France, Italy and Spain. It is also abundant in North America.

12. BOLTON'S WOODSIA. Woodsia alpina.

Woodsia alpina. *B. F.* 79.

The caudex is tufted, large in proportion to the entire plant, and apparently very enduring. In its vernation this species differs essentially from Ray's Woodsia: it forms a crown of simply circinate fronds, much more thinly clothed with buff-coloured scales, and its clusters of seeds are very conspicuous, even in its youngest state, and immediately it begins to unfold: unlike those of Ilvensis, its fronds are almost persistent, the plant appearing to be scarcely ever

in a state of perfect rest. The stalk is slender, and nearly smooth; it has a few small, scattered and pointed scales, and some very slender articulated hairs, amounting in a very young state to a fine pubescence, but both these appear to be easily removed, since in nearly all the mature dried specimens I have seen they were entirely wanting: the stalk is jointed, like that of Ilvensis; and I have a specimen which has two joints, a circumstance which I imagine is of unusual occurrence. The shape of the frond is long, narrow, linear and pinnate: the pinnæ are perfectly separate, sometimes distant, almost invariably alternate, and in shape somewhat triangular, the angles being rounded; they are lobed; the lobes are five or seven in number, and very obtuse; the first superior lobe is sometimes considerably larger than the rest, and slightly notched; the tip of the frond is pinnatifid and pointed: the margins and under surface of the pinnæ are sparingly furnished with jointed hairs. The venation is rather anomalous: no particular vein appears to possess a very decided superiority over the others; they are occasionally simple, but generally divided into two or three branches; they do not quite reach the margin of the pinnæ, and the clusters of seeds, when present, are placed at their extremity.

In Great Britain this little fern has only been recorded as discovered in one Welsh and two Scotch

counties. In the Snowdon district of Caernarvonshire it grows in the chasm called Clogwyn-y-Garnedh, which forms the eastern precipice of Snowdon, on rocks perfectly inaccessible; and also in the Pass of Llanberis, accompanied by Ray's Woodsia: in both instances the rocks are of a peculiar character, resembling limestone. On Ben Lawers, Mael-dun-Crosk, Craig Challiach and other mountains in Perthshire, and in Glen Fiadh, in Forfarshire.

Both this fern and the preceding are comparatively easy of cultivation under glass, care being taken to avoid excessive heat; no sunshine whatever should be allowed to reach them, not so much from any ill effect to be apprehended from the direct rays of the sun, as from the excess of heat always produced in a glazed case from the shining of the sun thereon: nevertheless sunshine, accompanied by the fresh mountain breeze, is perfectly innocuous. If potted, the pot should be first filled with thin pieces of stone, placed vertically; basalt, commonly known as "dew-stone," granite, freestone and sandstone, have all been found to answer: after the stone has been arranged, so as to surround the rim of the pot, the radicles of the fern should be carefully arranged between the central pieces, leaving the crown of the caudex just visible: then prepare a finely sifted mixture of thoroughly decayed leaf-mould, silver sand and peat earth; introduce this in a nearly dry state, and gently shake it down amongst

the stones until all the interstices are filled: on watering the surface this light mould will probably disappear; it should be repeatedly filled up and watered until all the fragments of stone only crop out here and there above the surface of the pot. Mr. Wollaston slightly differs in his directions for cultivating these ferns, recommending the addition of loam, as more retentive of moisture.

The Rev. William Little informs me that Woodsia Ilvensis grows freely with him in a cool green-house, and also under a frame, but that it thrives still more freely in the open air in a shady corner of the garden. Woodsia alpina is more difficult to cultivate: he has lost it several times. Mr. Little adds that the Moffat Hills are of the lower Silurian formation.

13. BRITTLE FERN. Fragilis.

Cystopteris fragilis. *B. F.* 87, 92.

The caudex is elongated horizontally, but very slowly, the extremity always having a vertical position, and terminating in a crown of unexpanded fronds. The fronds begin to unfold early in the spring, and appear very evanescent, generally arriving at maturity in a few weeks; a constant succession of fronds is produced throughout the summer and autumn, but all disappear with the first frosts of winter. The frond is

lanceolate and pinnate; the pinnæ are also pinnate; but beyond this they appear to possess no character in common. The length of the stalk is also very various. The lateral veins are alternate, and each is usually divided into three or four branches, one extending to every serrature in each lobe of the pinnule. Almost every vein bears a cluster of seeds near its extremity; the cluster is almost circular, and has a loose, white membranous involucre attached on one side only beneath the capsules; its margin, at the farthest extremity from its attachment, is striated, and becomes split into capillary segments, or sometimes torn in a ragged manner, and at length entirely disappears: the clusters of seed rapidly increase in size, frequently becoming confluent. In cultivation I have observed that sometimes, from the plant receiving a check from exposure or improper treatment, the clusters remain of small size and covered with the involucre, even after the frond has withered.

This pretty and fragile but hardy species has a very extended geographical range in the temperate regions of Europe, Asia and America, as well as the islands of the Atlantic Ocean. In Great Britain it is widely scattered; in the southern, eastern and some midland counties it is extremely rare in its natural localities, as on rocks. I have received specimens from churches or garden-walls in Dorsetshire, Sussex, Surrey, Kent, Essex, Suffolk and Norfolk: in Devon-

shire, Worcestershire, Warwickshire, Herefordshire, Shropshire and Cheshire it occurs more commonly, and in natural localities: still more abundantly in Somersetshire, Wiltshire, Gloucestershire, Staffordshire and Derbyshire, and profusely in the hilly regions of North and South Wales, Yorkshire, Lancashire, Westmoreland, Durham, Cumberland and Northumberland. In Scotland I have found it almost everywhere, both on rocks and buildings. In Ireland it may be called a rare fern: it, however, grows in profusion in some localities in the counties Sligo and Kerry, and I have received specimens from the counties Antrim, Down, Leitrim, Wicklow and Cork.

This little fern grows freely and luxuriantly in the usual soil of gardens in the counties where it is indigenous, requiring only air and moisture: on the north side of loose stone walls, provided purposely, Cystopteris fragilis seems especially to flourish. In pots it seems still more at home, if they stand in a cool and well-ventilated green-house, and if the soil be composed chiefly of peat, with a small portion of thoroughly decayed leaf-mould and fine sand: the caudex should be fixed in an erect position between stones, as recommended for the Woodsias. Mr. Wollaston, whose judgment in all such matters is most excellent, recommends the addition of loam. The pots should stand in water, half an inch deep, and the reader must recollect, whenever this is recommended, that it

is indispensable that there be lumps of charcoal at the bottom of the pot; this corrects the tendency to impurity which water, when still, is so apt to exhibit.

14. DICKIE'S FERN. Dickieana.

Cystopteris Dickieana, *Sim.* *B. F.* 93.

The caudex is tufted, exhibiting very conspicuously a pale brown salient crown, composed of the future fronds: the stalk is short, scarcely half as long as the leafy part of the frond: the frond is ovate-lanceolate, pinnate, compact, somewhat glabrous, and of a full bright green colour: the pinnæ are crowded, deflexed, broad, blunt and pinnatifid; the pinnules or lobes are notched: the fructification abundant: the clusters of seeds small, round, submarginal and generally naked; the involucre, when present, is small, its margin fringed, its attachment beneath that of the capsules: the seeds warty. Since, with the single exception of Mr. Sim, the original describer, no author has ventured to regard Dickieana as a species distinct from Fragilis, a few words appear absolutely necessary as to the propriety or otherwise of regarding this fern as distinct. The objections to separating it are two: *first*, the present restriction of the species to a single locality, and that a very peculiar one; and,

secondly, the absence of any obvious botanical character whereby it may be distinguished from Fragilis.

Both of these objections are my own; they are difficulties first suggested by myself, and therefore I am fully prepared to assert their importance, and shall make no attempt whatever to reason them away. The propriety of separating Dickieana from Fragilis rests on these grounds: it is a healthy, perfect plant, not monstrous or distorted, and it produces its like from seed for many generations. It is reproduced freely from seed, becoming a perfect weed; whereas Fragilis, under similar treatment, rarely reproduces itself. Cultivated in the same soil, and in the same pot, Fragilis invariably becomes larger and more vigorous, Dickieana smaller and less vigorous; and the more care the cultivator bestows on these two plants the more will he find they recede from each other. It is true that Dickieana, under cultivation, undergoes some change: its pinnæ are deflexed, crowded and partially overlapping in a wild state; they become more deflexed, crowded and overlapping under cultivation: the pinnæ of Fragilis are generally ascending separate and distinct in a wild state, and they become more ascending distant and divided under cultivation: Dickieana is of a bright glossy green in a wild state, and Fragilis of a dull somewhat glaucous green; this difference of colour is not only maintained but increased under cultivation: finally, and this is a

botanical diagnostic, the seeds of Fragilis are always spiny, those of Dickieana simply warty.

This fern is known to botanists from a single locality, a sea-cave near Aberdeen, where it was originally found by Dr. Dickie, and where it still exists.

Dickieana is to be cultivated in the same way as Fragilis, but, like all sea-side ferns, it seems to enjoy the protection afforded by glass.

15. HOLLY FERN. Lonchitis.

Polystichum Lonchitis, *Roth.* *B. F.* 103, 107, 108.

The caudex is woody, erect or recumbent through age, and long enduring, its upper extremity a brown, chaffy, but not very salient crown, composed of the undeveloped fronds: the stalk is very short, scarcely separable from the leafy part of the frond, and clothed with reddish, chaffy scales: the frond is linear and pinnate: the pinnæ are crowded, overlapping, somewhat crescent-shaped, auricled on the upper side next the stem, serrated and acutely spined; each pinna is sessile, but not decurrent, set on obliquely with the stalk, and twisted; this twisted character is least apparent in the Welch specimens, which have also a more lax habit than the Scotch and Irish plants; the Welch specimens, moreover, are generally pendulous;

the Scotch and Irish ones more usually erect: there is also a difference in the colour, that of the English and Welch specimens approaching the ordinary hue of Aculeatum, while that of the Scotch and Irish specimens is full, rich, shining green, the substance thick and leathery, and the entire frond as rigid and prickly as a spike of miniature holly-leaves, so much so, indeed, that the fronds are not to be flattened for the herbarium without considerable difficulty. The lateral veins are alternate and generally three-branched, the anterior branch usually terminating half-way between the midvein and the margin, the others reaching the margin but being quite free at the extremity. It should, however, be observed that the auricle or lobe at the base of each pinna has a formula of venation decidedly different from the remainder of the pinnule, since the principal vein in this lobe emits several fruitful branches in an opposite direction to that taken by the rest. The involucre is circular, and attached to the back of each anterior branch of the lateral vein, near its extremity; the attachment is by a short central stalk; the seeds are attached to the vein around the base of the stalk of the involucre, and, as they reach maturity, form a circular cluster, and these clusters a continuous line on each side of the pinna, about equidistant from the midrib and margin of each pinna. Some specimens are so densely seeded that the masses become con-

fluent. In Irish specimens the clusters of seeds are most abundant towards the tip of the frond, but they are also scattered throughout the other parts, even to its base; whereas in the Scotch, Welch, and particularly the English specimens, the masses are *confined* to the upper part of the frond.

Apparently a fern of frequent occurrence on the Continent, but I cannot speak with certainty on this, because the localities described in botanical works, as "woods," "subalpine woods," "moist woods," "shady woods," and so forth, seem to throw a doubt of the correctness of the name, since in Great Britain and Ireland we generally find the Holly Fern in the most elevated, exposed and barren mountain regions. In England it has only been found in Durham and Yorkshire; in the former county the only locality is Falcon Clints, ten miles west of Middleton; in the latter it occurs on Attermire Scar, on Ingleborough, and near Settle. In Wales it is confined to the Snowdon district, but occurs on both sides of the Pass of Llanberis. In Scotland it is more abundant, growing on Ben More, in Sutherlandshire; Ben Lawers and Craig Chailliach, in Perthshire; the Clova Mountains, Glen Fiadh and Craig Maid, in Forfarshire. In Ireland again it is a rare fern, but occurs in a few localities, of which I can mention two as coming within my own knowledge, having specimens from both; these are Brandon Hill, in Kerry, and Ben Bulben, in Sligo.

A difficult plant to establish, and even, when apparently established, often disappointing the cultivator. Still nothing can exceed the vigour which it displays when grown in the open air in some parts of Ireland, perhaps, indeed, throughout Ireland; but I may speak of Belfast and Dublin as places in which I have particularly observed it: on rock-work in the sister island it forms strong permanent masses, often displaying fifty fronds at once. In Scotland and the North of England I have had little experience of the success attending its cultivation in the open air; but in the South of England it rarely thrives; when potted, and kept in a cold frame or cool green-house it succeeds better. The following directions may possibly be of some service to those who incline to encounter the trouble and reap the reward of pot culture. Place the caudex erect between two flattish pieces of sand-stone or freestone, and then block up the space between them and the sides of the pot with other pieces of stone: do this *tightly*, compressing the caudex, keeping its crown well above the pot, and allowing the roots to hang down; then fill up with a light mixture of peat and sandy loam, and shake it gently down until the interstices of the stone are thoroughly filled. In watering this fern it is best to keep the water entirely from the leaves, unless, by thorough ventilation, you can ensure rapid evaporation.

16. PRICKLY FERN. Aculeatum.

Polystichum aculeatum, *Roth.* *B. F.* 111.

The caudex is very large, apparently increasing slowly with age, and enduring for many years. The young fronds make their appearance in April, the circinate apex being bent backwards, and remarkably graceful in its appearance: the pinnæ of the young frond are also circinate. The fronds attain their full expansion in July, and the seed appears to have reached maturity in September. The fronds are tough, leathery and perfectly persistent, retaining their green uninjured by frosts throughout the year, and showing no disposition to decay until the fronds of the succeeding year are fully developed; indeed they are of so rigid and durable a character that, after changing their green hue for one of brown, they remain almost unaltered in form; and thus Nature often preserves the fronds of three or four successive years attached to the same caudex, displaying to the inquiring gaze of the botanist a variation in character that will often strike him with astonishment. The form of the frond may be termed lanceolate, but it becomes more or less linear and more or less attenuated towards the base. The stalk is usually very short, and is densely clothed with reddish scales; these are very large and crowded at

its junction with the caudex, but upwards they diminish in size, and are much smaller where the stalk and leafy portion meet. The caudex has always a disposition to fix itself on a perpendicular surface, whence the fronds issue in a nearly horizontal direction, their rigid habit almost precluding the possibility of their assuming that graceful bend which is more or less observable in every other fern similarly situated. The frond is variously divided but always pinnate: the pinnæ also are variously divided. The first upper pinnule in each pinna is much larger than either of the others; indeed it is usually twice as large as the first lower pinnule; it points directly upwards towards the tip of the frond, but owing to a certain convexity, which every division of the frond in some degree possesses, the point is bent downwards, and very frequently passes below and beyond the midrib of the preceding pinna; the double series of these enlarged pinnules, often amounting to more than twenty, has a very striking appearance: all the pinnules have a sharp spine at their extremity and several lesser spines at their edges, and each of the enlarged superior pinnules is slightly auricled at its outer margin near the base, and the auricle, in those pinnules near the base of the frond, has a very strong and distinct spine: this character extends to several of the other pinnules which most nearly approach the stem, and these are generally placed on short foot-stalks, whereas all the others are

decurrent or united at the base; the direction which they assume, observable particularly in the inferior pinnules of each pinna, forms an acute angle with the midrib of the pinna. The seed is confined to the upper portion of the frond.

The European range of this fern extends to every country except Spain, where one would rather suppose it unobserved than absent, since it occurs commonly throughout France, especially in the South, and ascends the Pyrenees to the height of 2,500 feet. It is found in Asia, Northern and Southern Africa and North America: in the latter country it is extremely rare, but perfectly identical with our British plant. In one or other of its forms this fern seems to be distributed throughout the United Kingdom. I have seen it more or less abundantly in every county I have visited, whether in England, Wales, Scotland or Ireland; and the lists I have received through the kindness of my correspondents invariably record its occurrence. It seems to delight in the protection of man, its favourite locality being our hedge-rows; and its luxuriance being greatly increased by cultivation, or even by proximity to cultivated lands: its occurrence on our moors, commons and mountains is comparatively rare, its stature diminutive, and its fronds are more sparingly divided.

The Prickly Ferns, for it is needless to separate this from the following, are easily cultivated. They are so

much at home in our lanes and hedge-rows that their transplantation to a garden is always attended with success, and nothing can be more beautiful than their appearance. They even defy the impurities of the London suburban atmosphere, and exist for many years without any other care than an occasional watering. In the green-house they thrive still better, and it is almost impossible to conceive anything more elegant and delicate than the tracery of some of the more divided forms of Willdenow's Fern. The more divided the frond, the less durable; for whilst the leathery, rigid and scarcely bipinnate form commonly known as Lobatum shows no symptoms of decay until the end of the second year, the delicate and feathery plant called Angulare decays at its base during the first winter, and, falling to the ground, soon becomes entirely destroyed. All the forms delight in soil chiefly composed of yellow loam.

17. WILLDENOW'S FERN. ANGULARE.

Polystichum angulare. *B. F.* 117.

The caudex presents no characters by which I can distinguish it from that of the preceding. The stalk is distinct, about one-fourth as long as the frond, and densely clothed with large reddish scales. The plant appears to prefer a horizontal to a vertical surface;

its habit is weak, flexile, graceful and drooping; a number of fronds issue from the crown of the caudex, and, when uninterrupted, spread from a common centre, presenting a very beautiful appearance: the texture of the frond is soft and delicate; its form lanceolate and pinnate; the pinnæ are very numerous, elongate, linear, distinct, often distant, drooping and pinnate; the pinnules are blunt at the tip, auricled at the base, distinctly stalked and serrated at the edges, and each serrature is armed with a spine; every part of the under surface of the fronds, more especially the primary and secondary stalks, abound in reddish chaffy scales.

18. MARSH FERN. Thelypteris.

Polypodium Thelypteris, *Linneus*. *B. F.* 123.

The caudex of the Marsh Fern is slender, black and rapidly creeping. The fronds are of two kinds, barren and fertile; the barren appear in May, the fertile in July: the pinnæ of the young frond stand out at right angles with the main stalk. The stalk of the barren frond is long, smooth and erect; the frond lanceolate and pinnate: the lowermost pinnæ are rather shorter than the second, third or fourth pairs, still not materially shorter, and always situated a long distance from the base of the stalk: the pinnæ are generally nearly

opposite, distant, linear, slightly drooping and pinnatifid; the pinnules crowded, adnate, entire and rounded at the extremity: the habit is slender, delicate and very fragile; the texture thin and almost membranaceous; the colour pale green. The fertile frond differs in being much taller and more robust, and in having the margins of the pinnules convolute, and the pinnules themselves are thus rendered narrower and apparently more distant: the lateral veins of the pinnules are alternate; they are forked almost immediately on leaving the midvein, and each branch proceeds to the margin of the pinnule, bearing a nearly circular cluster of seeds about midway between the midvein and margin: at the back of each cluster in an early stage of the frond may be seen a small, flat, whitish, reniform involucre; this soon withers, is pushed aside by the swelling seeds, and is lost: the clusters of seeds become confluent, and are nearly concealed by the semi-bleached, semi-membranous margin of the pinnule.

The Marsh Fern occurs in every country of Europe; in Africa; in the Atlantic Islands and in North and South America. In Great Britain it must be considered local, but its distribution is very general. It occurs only on those boggy heaths where the soil is so moist and light that its caudex can extend itself with rapidity and freedom; in such situations it is found in great abundance. It may be observed that, as a rule,

it affects those districts from which the usual ferns of mountainous districts are entirely absent. The following stations are recorded on good authority:—In Surrey, in a small hollow in the heath between Woking and Tachborough; near Hurtmore Cottage; near Godalming; on Leith Hill; and on Wimbledon Common. In Sussex, in what is called the forest district at Albourne and Amberley; at Tunbridge Wells; at Waterdown Forest; and near Hastings. In Hampshire it occurs on the main land in one small spot near the city of Winchester; and at Freshwater Gate, in the Isle of Wight. In Somersetshire it covers thousands of acres on Turf Moor, between Bridgewater and Glastonbury; and also near Street. In Kent, at Ham Ponds, near Sandwich; and at North Cray. In Bedfordshire, at Potten Marshes. In Essex, at Epping and at Little Baddow Common. In Suffolk, at Bungay, Lound Hipton and Brodwell Common. In Norfolk it is common in all the fen districts, as Horning Marshes, St. Faith's, Upton Fen, Filby Broad, Holt Edgefield, Scaring Fen and Felthorpe Fen. In Warwickshire, near Allesley, and four miles N.W. of Warwick. In Shropshire, at Berrington Pool. In Nottinghamshire, at Oxton Bogs and Bulwell Bogs. In Cheshire, at Newchurch Bog, near Over, on Knutsford Moor and on Rostherne Moor. In Yorkshire, at Potterie Car, Scarborough, Askham Bog, near York; at Heslington Fields and Terrington

Scar. In Cumberland, at Glencoin, Blowike and near Ulswater and Keswick. In Westmoreland, at Hammersham Bogs; and in Northumberland, at Learsmouth Bogs. In Wales, it is found at Llanberis, in Carnarvonshire; at Llwydiard Lake, in Anglesea; and at Cwmbold and Sketty Bogs, in Glamorganshire. In Scotland it is rare or absent. In Ireland it is very uncommon; but has been found at Portmore Park, on the shore of Lough Neagh, in County Antrim; near Lough Carra, in County Mayo; and near Muckross, in County Kerry.

This fern grows freely, provided the soil be sufficiently peaty, and the supply of moisture abundant; if this can be done in no other way it may always be accomplished by digging out the ordinary soil and making a cemented bottom upon which to spread the peat: saturate this thoroughly with water; too much cannot be given, as the caudices will thrive equally well when constantly submerged. For green-house cultivation, use the largest obtainable seed-pan without any apertures for the escape of water; sift peat earth through a coarse sieve, and mix it with charcoal broken small, in the proportion of seven parts peat and one of charcoal: arrange the caudices among this compost and saturate with water: no protection against sun is required.

19. MOUNTAIN FERN. Montana.

Polypodium montanum, *Vogler.*
Polypodium Oreopteris, *Ehrhart.*
Lastrea montana. *B. F.* 129.

The caudex of the Mountain Fern is large, scaly and tufted. In favourable situations this sends forth thirty or forty fronds, which spread with but little regularity round a common centre: immediately these begin to unrol they exhibit the pinnæ, placed at right angles with the main rachis, and are not convolute, a character worthy of particular notice, because unusual. The fronds, when fully expanded, are very variable in size, dependent chiefly on situation, but also in a great measure on the age of the plant. An extraordinary number of seedlings are met with where this fern is abundant; these, for two or three years, bear little or no seed, but after the third year seed appears in abundance, and from that period all the fronds are fertile. In the form of the frond there is little or no variation: it is elongate-lanceolate, and regularly pinnate: the pinnæ are rather distant, pinnatifid, acute at the tip, and gradually diminishing from about two-thirds of their length to the very base, the lower pinnæ being remarkably short and nearly triangular in form: this attenuation of the frond towards the base is an excellent character, and is of itself sufficient to

distinguish the present from any other British fern. There is but a very small portion of stalk below the pinnæ, and this is nearly hidden by pale brown scales. The pinnules are rounded and slightly crenate:. over the entire under surface are scattered small, yellowish, glandular globules, which are adhesive to the touch, and emit a powerful but not very agreeable odour: it is probably in consequence of this property that the species was originally named "Polypodium fragrans," or the fragrant Polypodium, by Linneus. The veins in the pinnules of the Mountain Fern are alternate, and are either simple or branched: all the veins are fruitful. Sometimes the veins or branches are again divided just before their termination, and then each of the subdivisions is usually fruitful: all the veins and branches cease just before the margin of the pinnule: the clusters of seeds are circular, and are placed very near the extremity of each vein, so as to form a nearly marginal series. In some instances, but by no means generally, a small, torn, white involucre is to be seen near the centre of each cluster of seeds. This involucre is said to be reniform, a character I have never been able to detect: in general the clusters are perfectly naked, and even before the frond has unrolled this absence of an involucre is equally manifest, a circumstance worthy of notice, as showing that its frequent absence is a character, and not the result of age or accident.

The Mountain Fern occurs throughout Europe more or less abundantly, and a few roots have been found in Madeira, but I believe in no other part of the world. In many of its characters it is so like the last that it is constantly taken for it, a circumstance that has led to many errors on the subject of localities. In Britain it is an inhabitant of mountain districts: it is more rarely found on low ground, and very seldom in highly cultivated counties. It is particularly abundant in the Highlands of Scotland, being in many of the mountain wilds more common than the Common Brakes: it also abounds in the hill districts of the North of England and Wales: it is not, however, confined to hills, since we find it sparingly in all our counties where there is waste ground; it approaches London on all sides, occurring on Wimbledon Common, Hampstead Heath, High Beech and Blackheath. Notwithstanding its apparent partiality for exposed and elevated districts, it grows more beautifully and luxuriantly in the woods, especially where they are intersected by a little stream, on the banks of which it will often be observed in profusion. At Houndsdown Bottom, near Hindhead, in Surrey, it is particularly abundant and luxuriant; and the same is the case in Eridge Woods, near Tunbridge Wells. In Ireland it is sparingly distributed; I was, however, fortunate in finding it rather abundantly in two localities, Milroy Bay, in the County Donegal, and at Glendalough, in the County Wicklow: it also

occurs in Kerry, Londonderry, and in several places in Galway, as between Dooghty and Ma'am, on the ascent of Ma'am Turc Pass to the Ma'am Hotel, and near Letterpark.

20. BREE'S FERN. Recurvum.

Aspidium recurvum, *Bree*. *B. F.* 135.
Lastrea Fœnisecii, *Watson*.

The caudex is remarkably large, solid and woody, its crown broad and circular, and the undeveloped fronds seem unusually numerous, and look like a mass of nodules crowded together. The fronds on first rising from the earth are regularly convolute, and when they exhibit the first symptoms of unfolding, the two lower pinnæ are very conspicuous, and their superior size is still more manifest than at a later period. When the leafy part of the frond is entirely unfolded, it is of an elongate-triangular form, of a gracefully curved habit, and about equal in length to the stalk, which is dark purple in colour, very hard and woody in texture, and very long enduring; it is clothed with long, narrow, notched, pointed, brown, concolorous scales, which in luxuriant plants are frequently so numerous and so divided as to give the stalk a woolly appearance. The frond is pinnate, and, as in all truly deltoid ferns, the lower pinnæ are notably larger and

longer than the rest, and very distinctly stalked. The pinnæ are pinnate, the pinnules pinnate, and the lobes again divided and toothed, and all the teeth terminate in short spines. The inferior pinnules are generally larger than the superior, and the first inferior pinnule of the lower pair of pinnæ is vastly superior to all the rest in magnitude. The colour of the young frond is a most lovely green, and all its ultimate divisions are concave, giving to the plant, especially when young and barren, a very peculiar and crisped appearance. The under surface of the frond is abundantly sprinkled over with minute, sessile, pellucid, globular, and, I presume, glandular bodies. The clusters of seeds are circular, and are equally distributed over all the frond; they are partially covered by a slightly convex and somewhat reniform involucre, the margins of which are jagged and uneven, and are sometimes beset with a few of those globular, sessile glands which have been described as sprinkled generally over the under surface of the frond.

This fern is abundant in the Islands of the Atlantic, but I am doubtful whether it exists on the continents of either the New or Old World. In Ireland it is extremely common, the localities being far too numerous to particularize: I must, however, mention that it forms the great ornament of the woods about Killarney and in the county of Wicklow. In England it abounds in Cornwall; it occurs at Clovelly and Hels-

worthy, in Devonshire; at West Hoathly, in Sussex; at Tunbridge Wells, in Kent; at Scarborough and Settle, in Yorkshire; and at St. Bees' Head, in Cumberland. In Wales, at Melincourt Waterfall, in Glamorganshire; in the Snowdon district, Caernarvonshire; on the Holyhead Mountain, in Anglesea. In Scotland, it is a rare fern, but I have seen a specimen from the neighbourhood of Loch Lomond, and others from the Islands of Arran and Mull.

A most desirable fern, both for the garden and the green-house. It grows readily in the ordinary mixture of loam, peat and sand, requires abundant watering, and enjoys shade. In the garden it should, if practicable, be placed on a rockery composed of sandstone: in a green-house it is the very best of our British species; its beautiful colour, truly evergreen character, and perfect hardiness, render it of unequalled value as a house fern. As it is a remarkably neat and compact plant, and never addicted to coarse or rambling growth, a number of roots may be planted together, and produce a very pleasing effect. Having first obtained a seed-pan of the largest size, cover the bottom with Sphagnum and charcoal, the latter in lumps as large as a hazel nut: fill the pan to its rim with a mixture of peat-earth and sand, and, after pressing this down, saturate with water; then, having previously provided twenty or thirty small plants of the fern, and as many moderately-sized pieces of sand-

stone, build a conical pile above the soil already in the pan, intermixing stones and ferns, and filling the interstices firmly with the compost.

21. ROTH'S FERN. MULTIFLORUM.

Polystichum multiflorum, *Roth*. *B. F.* 147.

The caudex is large and tufted; I have never found it either horizontally elongated or branched. The crown of the caudex is densely clothed with large, long, dark brown scales. The fronds rise early in May: they are symmetrically arranged round the crown, and are characterized by a peculiarity in vernation which I have not hitherto seen noticed; the main rachis of the frond, instead of being regularly convolute, or composed of diminishing rings, like those of an Ionic volute, is doubled near the insertion of the second pair of pinnæ, and turns back, forming a kind of loop. In favourable situations, the fronds of mature plants, including the stalks, measure five feet in length: this magnitude is, I believe, unequalled by any of our British ferns, except the Common Brakes and Osmunda regalis. The stalk is very stout at the base, and thickly clothed with long pointed scales, which are of a very dark brown colour along the middle, pale brown and nearly transparent at the sides; this character is amply sufficient to distinguish this species

from those which are generally confounded with it. The frond is pinnate: the pinnæ are nearly opposite, and the pairs gradually approximate from the base towards the apex: the first and second pairs are very broad at the base, in some instances nearly triangular; the third is longer and narrower; the fourth, fifth and sixth still longer and narrower and also more linear, the sides being nearly parallel: all the pinnæ are pinnate, except those quite at the apex of the frond: the pinnules are distinctly separate, and almost stalked; those of the upper pinnæ are connected by an extremely slender wing of the midrib of the pinna, but this wing is not to be distinguished on the lower pinnæ, except near the point: the pinnules of the lower pinnæ are pinnate, those on the middle are pinnatifid, and on the upper deeply lobed: all the divisions are toothed, and each tooth terminates in a short but distinct spine. In the first, second and third pairs of pinnæ the inferior pinnules are generally longer than the superior; the first, second and third inferior pinnules of the first pair of pinnæ are almost invariably longer and altogether larger than those which succeed them; the diminution of the rest in size is sometimes very abrupt, sometimes gradual. Every lateral vein supplies one lobe or division of a pinnule; it is always branched, and almost every anterior branch bears a cluster of seeds: these clusters are scattered generally over the frond, without any definite

arrangement: they are covered by a very irregular but somewhat reniform involucre, the margins of which are uneven, and more or less fringed with stalked transparent glands.

This fern appears common on the Continent of Europe: and is certainly universally distributed in the British Islands. It grows luxuriantly in moist woods, delighting in vegetable mould, and attains a great size on warm sheltered hedge-banks, particularly when these are accompanied by a ditch.

Multiflorum grows freely in cultivation: planted in rich vegetable mould it attains an enormous size: it should be abundantly supplied with moisture.

22. BENNETT'S FERN. GLANDULOSUM.

Lophodium glandulosum.

Caudex very large, solid and long enduring; its position vertical; its crown very smooth, of a pale whitish brown colour, composed of undeveloped fronds, which are covered with pale, rounded, concolorous, closely appressed scales; fronds very large, semi-erect, arranged symmetrically round a centre; every part of their under surface, including the general and partial stalks, so densely covered with minute stalked glands as to convey a most evident appearance of mealiness to the eye, and of roughness and stickiness to the

touch. The fronds are pinnate; the pinnules are lobed and toothed, and the teeth terminate in a short spine. The involucres have stalked glands on their edge, and a few occasionally, not constantly, on their disk.

The Forest of Dean, in Gloucestershire, and Epping Forest, in Essex, appear to be the only reliable localities for this fern.

This handsome fern grows luxuriantly in peat with an admixture of leaf-mould; it retains every peculiarity, and reproduces itself readily from seed. Cultivated side by side with Multiflorum and Spinosum, under circumstances calculated to produce the greatest state of luxuriance and vigour, it remains notably distinct from both. In a green-house it requires a very large pot; a rich vegetable soil intermixed with peat; abundance of water, and good drainage.

23. WITHERING'S FERN. Spinosum.

Polystichum spinosum, *Roth.* *B. F.* 157.

The caudex is stout, and gradually increases in length, and becomes branched: I have occasionally seen in woods patches that occupied many square yards, and, on digging amongst the fronds with a trowel, have found the tufts so much connected with each other as to justify the supposition that each patch

originally owed its existence to a single plant. The fronds rise from the ground in April and May, without any symmetrical arrangement, and often exhibit the singular vernation already described under Multiflorum: the margins of the unexpanded pinnæ are somewhat convolute. The stalk is about equal in length to the leafy part, and nearly erect; it is clothed with blunt or rounded, semitransparent, uniformly coloured scales, each of which generally terminates in a feeble hair-like point. The frond is quite eglandulose; it is long, narrow, pinnate and linear, the pairs of pinnæ, from the first to the eighth inclusive, being generally of uniform length; they are rather distant, and usually ascend at an acute angle from the main stalk. The pinnæ are pinnate, and the pinnules detached and often distant, although connected by a slender wing; they have a deep notch on each side at the base. On the first pair of pinnæ the first and second inferior pinnules are of nearly equal length, and are nearly twice as long as the corresponding superior ones: this discrepancy between superior and inferior pinnules gradually diminishes, and it altogether ceases with the sixth pair, which are of equal length: a somewhat similar discrepancy is observable in the pinnules of the second pair of pinnæ, but beyond these it becomes scarcely observable: some of the lower pinnules are deeply pinnatifid, almost pinnate: the lobes of the pinnules are toothed, and the teeth terminate in short

but sharp and distinct spines; each tooth, with its accompanying spine, has a decided curvature towards the apex of the pinnule. The veins of the pinnules are alternately branched, each system of branches entering a division of the pinnule, and the anterior branch bearing a circular mass of seeds just within the notch which occurs between each two divisions: this mass is covered by a flat, reniform involucre, the margins of which are waved, entire and *without* glands, a character which, as far as my observation has extended, is constant, and is of great importance in distinguishing the present plant. Owing to the constant position of the clusters on each pinnule, they form a regular double line, the midvein of the pinnule passing up the centre; but when the pinnule is completely divided into lobes each branch of the vein usually bears a mass of seeds: this is more frequently the case in those pinnules which are nearest the main stalk of the frond; and it may be observed that the masses on all, except the usual seed-bearing branch, are of smaller size. The seed, as pointed out by Linneus and Withering, is confined to the upper portion of the frond. The masses are usually distinct and perfectly separate. Each branch of the vein enters one of the teeth of the pinnule, but terminates before reaching the spine, with which it is quite unconnected.

Like the last, this fern should be planted in peat,

which may be mixed with any light soil of the garden, and it is important to the well-being of the plant that it should be well supplied with water. In potting, great care should be taken that the pot be sufficiently large and the compost sufficiently peaty. I believe it difficult to keep it too wet, nor is it important that the drainage be good. I cannot recommend this as an ornamental fern: it is easily broken by the wind, or other casualties, and very early in the summer assumes a shabby and battered appearance; still the fern cultivator should keep it with as much care as the most beautiful, as he will assuredly hear its claims to specific dignity earnestly, if not warmly, discussed.

24. LLOYD'S FERN. Uliginosum.

Polystichum spinosum, *var.* uliginosum, *A. Braun.*

The caudex is tufted. The fertile fronds are arranged shuttlecock-fashion, spreading from a common centre; in form they are linear, sharply pointed at the tip; thirty inches long, four and a half inches wide; pinnate; vernation simple, not twisted: the stalk is nine inches in length, and is deeply grooved in front, flattened at the sides, rounded behind, glabrous, bright green above, purple at the base, slightly tinged with purple at the back: the scales are somewhat sparingly distributed, obtusely

oval, with a lengthened sharp tip, which is generally twisted, and which terminates in a hair-like point; pale brown, transparent and entirely of one colour: these larger scales are intermixed with others very slender and hair-like: all the scales readily fall off and leave small black stars on the stalk. Pinnæ elongate-triangular, with sharply pointed tips and a winged midrib; the first, second and perhaps third pair rather shorter and rather broader at the base than the fourth, fifth and sixth pairs, and hence rather more triangular; they are set on the main stalk rather obliquely, so that their upper surface approaches a horizontal position, although the frond is nearly erect. The pinnules are of moderate size, sessile and deeply notched, the divisions toothed, and each tooth terminates in a little spine: the first inferior pinnule is longer than the first superior one. Masses of seeds on all the pinnæ, but less abundant on the lower ones, relatively small, remaining distinct and separate, except at the apex of the frond; at first green, then white, subsequently black and finally bright brown.

A great many botanists contend that this fern is not distinct from the last; others contend it is identical with the following; but these opinions are very unimportant, as all cultivators are well acquainted with the plant, not merely by name, but also by sight.

This fern is common in Rhenish Prussia, and grows in boggy places in company with Callipteris. In Britain it has only been found in four localities, all of them marshy and exposed: Wybunbury Bogs, Cheshire; Oxton Bogs, Nottinghamshire; Bawsey Heath, Norfolk; and Epping Forest, Essex.

Uliginosum grows freely in cultivation, retaining all the characters which distinguish it as a wild plant: in the spring it is twenty days later than Multiflorum in expanding, ten days later than Spinosum, and from ten to fifteen days earlier than Callipteris. When potted it requires nothing but peat, and the pot should be kept constantly standing in water.

25. EHRHART'S FERN. CALLIPTERIS.

Polypodium Callipteris, *Ehrhart.* *B. F.* 169, 173.
Aspidium cristatum, *Sir J. E. Smith.*

My readers will find this fern generally known by the name of Cristatum, given it by Sir James Edward Smith, one of our ablest and most distinguished botanists. The objections I have to retain this name are, *first*, that Ehrhart's name is older than Smith's; and, *secondly*, that Linneus, who gave the name of Cristatum before either of these illustrious botanists had been heard of, applied it to a group of

ferns, of which Recurvum, Multiflorum, Glandulosum, Spinosum, Uliginosum and Callipteris are constituent parts. Many very able botanists still regard Spinosum, Uliginosum and Callipteris as varieties of one species, an opinion which it is not necessary to controvert, because we shall find it impossible to arrive at a satisfactory conclusion; the great requirement seems to me to gain a knowledge of the objects, and to leave to such philosophical writers as Mr. Darwin to assign to each the rank it ought to hold in the general system.

The caudex of Callipteris is very stout, and gradually increases in length as the plant increases in age, occasionally emitting a lateral branch, which in due time also becomes branched, so that an old plant is sometimes possessed of a very extensive and complicated caudex, which throws up fronds from all its extremities. The base of the stalk of each frond, instead of decaying with the frond, retains its sap and vigour for many years, and in time assumes so nearly the appearance of the caudex itself that it is difficult to separate them. The fronds are but few in each tuft, and rise from the crown of each growing branch of the caudex; they appear in May, and remain green until near the end of the year: the form of the young unexpanded frond somewhat resembles that of the Mountain Fern: the general character is circinate, but the pinnæ are perfectly flat. The stalk is of

nearly equal length with the leafy part of the frond, very erect, and clothed with scattered, broad, obtuse, short, semitransparent, pale brown, uniformly coloured scales. The frond itself is erect, rigid, narrow, linear and pinnate: the pinnæ, which are attached by their midrib only, are generally rather distant, short, broad at the base, nearly triangular, and either pinnate or deeply pinnatifid: the pinnules are very blunt at the tip and toothed both at the tip and along the sides: they are united together at the base, and are almost invariably attached to the midrib of the pinna by their greatest diameter. When the frond is very luxuriant and fruitful the pinnæ are longer and the pinnules more distant from each other. The lateral veins of the pinnules are many-branched, and the anterior branch bears a circular mass of seeds about half-way between the midvein and edge of the leaf; these masses are covered by a flat, kidney-shaped involucre, the edges of which are waved, but not jagged or torn: in luxuriant specimens the masses are much crowded and at last become confluent: the seed is always confined to the upper part of the frond.

Callipteris is common on the continents of Europe and North America, but has not been found in the Atlantic Islands. In England it occurs in three counties: Wybunbury Bogs, in Cheshire; Oxton Bogs and Bulwell Marshes, in Nottinghamshire; Bawsey Heath, near Lynn, near the village of Dersingham,

between Lynn and Hunstanton, and at Edgefield, all in Norfolk. It occurs only on boggy heaths.

This fern, whether exposed or in a green-house, requires a soil almost entirely composed of turfy peat, abundance of water, and only just so much charcoal at the bottom of the pot as will keep the water, in which it should constantly stand, from putrifying. It is by no means an ornamental fern, erect, fragile, constantly broken by the wind, and very liable to premature decay at the tip of the frond: it is only desirable as affording the means of comparison with allied species.

26. WINDERMERE FERN. Remotum.

Aspidium remotum, *A. Braun.*

The caudex of Remotum is tufted, and the crown scaly; the whole frond is about three feet in length, of which the stalk is about a fourth part, or nine inches, and the leafy part of the frond twenty-three inches; the stalk is erect, stout and clothed with semitransparent pale brown scales, infinitely varied in form and size; the larger ones are rather broad at the base, and gradually taper to the tip, where they terminate in a twisted hair-like point; others are hair-like throughout, and these last are found not only on the main stalk, but also on the partial stalks and on

the midribs of the pinnæ. The leafy part of the frond is entirely without glands, in this respect resembling Spinosum, Uliginosum and Callipteris: it is elongate-lance-shaped and pinnate; the pinnæ are also pinnate and very decidedly stalked; those at the base are more distant, shorter and broader than those in the middle; the pinnules sessile, but united to the midrib only by their midvein; they are pinnatifid on the sides, and sharply pointed at their tips; the divisions or lobes are slightly notched on the sides and toothed at the tips: the midvein of each pinna is waved and emits alternate lateral veins, which run into the teeth on the edge of the leaf; each of the lateral veins bears a nearly circular mass of seed nearer the midvein than the edge of the pinnule, whence the name Remotum, these masses being more remote from the edges of the pinnules than in the allied species: each mass is covered by a somewhat kidney-shaped involucre, which soon shrivels, but remains attached by its little foot-stalk until the frond has withered. The seed seems to be produced principally, but by no means exclusively, on the upper part of the frond, as we generally observe to be the case in both Spinosum and Rigidum, the two species which Remotum is thought most nearly to resemble.

Professor Braun discovered this fern at Baden Baden, in Saxony, and described it in Doll's 'Rhenish Flora': he had the kindness to send me the

specimens from which the preceding description was taken: in 1859, Mr. Frederic Clowes, of Windermere, found the same fern in his own neighbourhood, and thus added a species to our list of British Ferns. It has not been observed elsewhere in Great Britain or Ireland. I am indebted to Mr. Clowes for the opportunity of examining Windermere specimens, which I have carefully compared with those received from Professor Braun, and believe them identical.

In cultivation it may be treated like Spinosum; planted in peat-earth in an open border; or, if in a green-house, good ventilation as well as drainage should be secured.

27. RIGID FERN. Rigidum.

Aspidium rigidum, *Schkuhr.* *B. F.* 175, 180.

The caudex is large and tufted; the stalk is unusually thick at the base, and very thickly clothed with large, pale red, concolorous scales, which are present, although less abundant, throughout its entire length; the proportion of the stalk to the leafy part of the frond varies between a fourth and a half; the frond is nearly erect, the leafy part lance-shaped and pinnate: the pinnæ are more or less crowded; those towards the base are more distant than those in the middle and upper part of the frond; they are also

sometimes shorter and more triangular, but this character appears rather the exception than the rule; for, in the specimens before me, I find by far the greater number have the first pair of pinnæ fully as long as either of the others: all the pinnæ are pinnate: the pinnules are sessile, but attached by a very narrow base, and so deeply divided into lobes as to appear almost pinnatifid; the lobes are toothed, the teeth broad and scarcely spined; this character I consider of importance, as affording an excellent diagnostic whereby the present species may be readily distinguished from its congeners. The lateral veins are alternate, and each is forked almost immediately after leaving the midvein: the hinder branch is again divided, and each ramifies into a tooth of the lobe: the anterior branch bears a mass of seeds about midway between the midvein and the edge of the pinnule; these masses, which are ten or twelve in each pinnule, are always approximate, and finally completely confluent; each of the masses is covered by a kidney-shaped, lead-coloured involucre, which is attached to the vein by a short stalk placed in the lateral notch. The involucre is furnished with a fringe of stalked glands. Over the surface of the frond are scattered numerous minute, spherical and nearly sessile glands; from these, in all probability, is emitted the scent which has caused so many authors to call this plant by the name of Fragrans; they are more conspicuous in the

living than in the dried plant, and sometimes impart to it a glaucous hue.

The Rigid Fern is a native of Hungary, Germany, France, Italy, Russia and Siberia; but has not been discovered in North America, the fern so named by some American botanists being totally different. It is confined to limestone rocks in mountain districts. In England it grows in profusion in the county of Westmoreland, on and near Arnside Knot, Farlton Knot and Hutton Roof; in Yorkshire, on Ingleborough, and abundantly in the fissures of the limestone rocks near Settle, at an elevation of 1550 feet above the level of the sea, and 1050 feet above the town of Settle, and also on the rocks called White Scars, above Ingleton; and in Lancashire, near the top of the Lancaster and Kendal Canal: a single plant, probably planted, has been found near Bath, and about thirty plants on a wall at Townley Hall, the residence of Mr. Balfour, in the County Louth, in Ireland. It has not been observed in Scotland or Wales, and I do not regard it as a native in the Somersetshire or Irish localities.

This fern grows with vigour in the ordinary soil of gardens, requiring no shade, but enjoying moisture. In pot cultivation, I find it thrive tolerably well in a mixture of peat and loam, with pieces of limestone or oolite intermixed: it seems to enjoy abundant watering, and likes being watered with lime-water. The drainage

must be good, as its roots will not bear constant contact with water: in the hill regions, where it abounds, the fall of rain is frequent and abundant, but the water passes off by percolation through the soil, or by other modes of escape, and never stagnates about the caudices or radicles of the fern.

28. MALE FERN. Filix-mas.

Polypodium Filix-mas, *Linneus.* *B. F.* 183, 193.

The caudex is tufted; if in a favourable situation it elongates slightly every year, so that in very old plants it makes a decided appearance above ground, and its crown appears to be seated on a short trunk; sometimes, however, it assumes a pendant position, the crown of the caudex curving at the extremity, and the fronds growing in a nearly erect position. The fronds make their appearance in May; at first they are perfectly convolute, but after a few days the apex of each is liberated, and hangs down, the frond at this period possessing the bend which characterizes a shepherd's crook. In this state it is very tender, and is frequently cut down by the late frosts of spring; the loss is, however, quickly repaired; a second series of fronds make their appearance, and, expanding at a more congenial season, arrive safely at maturity. The fronds are mature in August, and last till the middle of winter quite uninjured; they are generally fertile,

but plants are not of unfrequent occurrence which produce only barren fronds; and these are larger and greener, and have the pinnules more deeply toothed than when fertile. The fronds vary from five to ten or more in number; their position is nearly erect, or, perhaps, somewhat slanting, and radiating from a common centre. The length of the fronds averages between two and three feet, and the stalk constitutes nearly one-fourth of this, and is very chaffy. The form of the leafy portion of the frond is lance-shaped and pinnate; the lower pinnæ are considerably shorter than those in the middle of the frond, yet never approach the diminutive size so remarkable in the Mountain Fern: all the pinnæ are nearly linear, but acute at the tip; they are regularly pinnate: the pinnules are rather blunt, toothed at the tips, and notched at their edges. The lateral veins are forked half-way between the midvein and the edge: after the fork, the anterior branch bears a nearly circular mass of seeds; these are covered by a smooth, lead-coloured, kidney-shaped involucre, which is attached at its notch to the back of the vein; the edges of the involucre are involute, seeming to wrap round the seeds; the involucre is more perfect, conspicuous and lasting than in any other British fern: the lateral veins do not quite reach the edges of the pinnules, and the anterior branch of each is not quite so long as the posterior.

The Male Fern is found in every country of Europe and Northern Asia, and has been collected in Africa. Beck gives it as a native of North America, but it does not occur in either of the collections I have received from that continent. In Britain it is a most abundant species, and one which seems to delight in wooded and cultivated districts: although scattered over every part of the kingdom, it is ever most abundant in rich soils and shady situations; it lives to a great age, and the fronds of each succeeding year appear to increase in size.

The Male Fern is remarkably easy of culture: it enjoys rich and light soil of any kind. It has a very beautiful appearance when grown under trees.

29. COMMON LADY FERN. Filix-femina.

Polypodium Filix-femina, *Linneus.* *B. F.* 207, 213, 214, 218.

The caudex of the Common Lady Fern is very large, and its position erect; it sometimes rises several inches above the surface of the ground; in one instance I have seen it more than a foot in height, thus exhibiting a considerable resemblance in habit to the Tree Ferns. The fronds make their appearance in May; at first their vernation is convolute, but as

they advance the apex becomes free, and hangs down, assuming the appearance of a shepherd's crook: the form of the frond is lance-shaped and regularly pinnate: the pinnules are either simply toothed, or pinnatifid or pinnate, varying in different specimens; almost every two plants differ in this respect, and some cultivators, laboriously idle, have assigned Latin names to these varieties, which, like the slight differences among our fellow-creatures, are of no interest in Science, but yet are sufficient to distinguish individuals from each other, and it is argued that, as we know the members of a family not only by sight but by name, so should we be able to distinguish and name every individual plant,—a theory that, while it cannot be disputed, would, if carried into practice, render the study of Natural History absolutely impossible. The stalk varies from a quarter to a third of the entire length of the frond, and is swollen and dilated at the base; it has numerous long blackish scales, which are particularly abundant at the base, and more scattered, smaller and less observable on the partial stalks: the principal stalks are frequently tinged with purple and red; in some instances I have seen them assuming almost the colour of coral. The midvein of the pinnules is waved; the lateral veins are forked shortly after leaving the midvein, and each branch runs into one of the teeth, but ceases before actually touching the edge: the anterior branch

of each bears on its side, about midway between the midvein and margin, a linear mass of seeds, covered with a crescent-shaped white involucre, the free edge of which is split into numerous hair-like segments. The frond is extremely tender and fragile, and withers almost immediately on being gathered.

All the forms of this truly beautiful fern occur in every country of Europe; and others very similar have been found in Africa, Asia, Australia, and the Northern States of America. In Britain the Lady Fern seems to claim precedence in beauty over every other species: the exquisite grace of its habit, the elegance of its divisions, and the brilliant delicacy of its colour, combine to render it an object of general admiration. It may, perhaps, require some knowledge of kindred species fully to understand the peculiarities which unite in giving to this fern its superiority over the rest; but dull indeed must be the perception, and cold the heart, that fails to appreciate its excessive loveliness. It is distributed more or less abundantly throughout the British Islands, its favourite resort being moist or warm woods; but it does not shrink from the exposure of open moors and naked hill-sides, and, if sheltered by masses of weather-worn rock, its delicate fronds may often be found developing their fragile pinnules amid the inclement blasts of our Scottish Highlands. In Ireland it is more abundant, though less beautiful, than in England: there it

abounds on all the bogs, and is used as packing for fish and fruit, as we see the Common Brakes employed in this country.

No fern is more desirable as a garden ornament than the Lady Fern. The soil should be light and peaty, and the supply of wet can scarcely be too abundant: the roots will bear constant submersion during the summer season, when a succession of fronds is in course of development. In a green-house it should have a large pot and a deep saucer filled with water. The monstrous forms of the Lady Fern are great favourites with cultivators, some few for their beauty, but chiefly on account of their long Latin names.

30. ALPINE LADY FERN. Alpestre.

Aspidium alpestre, *Schkuhr.* *B. F.* 199.
Aspidium rhæticum, *Swartz.*

Caudex massive, enduring, erect, exhibiting no tendency to lateral elongation: its crown broad, gibbous, scaly; fronds arranged with regularity round the crown, but the symmetrical appearance is lost when lateral crowns are formed; stalk short, clothed, but not densely, with long, pale brown, half transparent scales, which are broad near the base and acute at the tip: fronds broadly lance-shaped, stiff,

pinnate; pinnæ twenty or thirty, on each side, before they begin to merge in the tip of the frond, close together, ascending, somewhat linear, acute, pinnate: pinnules about twelve pairs on each pinna, sessile, but the point of attachment so narrow that they appear almost stalked, broad at the base, deeply divided into lobes on the sides, rather acute at the tip; the lobes as well as the apex toothed: the lateral veins once or twice forked: the masses of seed small, quite round, seated on the back of the anterior branch of the vein, but not at or very near its extremity, each having the appearance of being seated in a notch between the two lobes of a pinnule; generally without involucre. Very closely allied to the Common Lady Fern, but, I think, distinct as a species.

This fern is so uniformly confounded by tourists and travellers with the Common Lady Fern, that it is impossible to define its geographical range on the Continent of Europe, where, however, it occurs, without doubt, in Norway, Sweden, Switzerland, Germany and Russia. It is abundant in the Highlands of Scotland, where our botanists, without exception, mistook it for the Common Lady Fern, until 1851, when Mr. Watson, entertaining a doubt as to the correctness of this conclusion, kindly showed me a dried specimen, when I instantly recognised it as the Aspidium alpestre of Schkuhr. The following

communications on the subject of localities will be read with interest. The first is from Mr. Watson:—"In July, 1841, I gathered two fronds of this fern in the great corrie of Ben Aulder, a lofty mountain on the west side of Loch Erricht, Inverness-shire, which is part of the boundary line between the East and West Highland provinces. Another frond of the same species was picked at some other spot in the neighbourhood of Loch Erricht, probably on the hills between Ben Aulder and the north end of the lake, but it might be on the hills of Drumochter Forest, eastward of the lake; and if the latter, the station would be within Moray or Eastern Inverness. In 1844 I brought a frond of it from Canlochen Glen, in Forfarshire. These specimens (except the second from Ben Aulder, given to Mr. Babington) remained in my herbarium doubtfully labelled until Mr. Newman (to whom the Canlochen frond was at length shown, when again recollected) decided it to be Polypodium alpestre. Now that it is known to be a native of at least two Highland counties, we may reasonably expect that it will be found in other counties by botanists who seek it in the knowledge of its close resemblance to Athyrium Filix-femina, for which latter fern this species may readily have been mistaken and passed by." It has since been found in vast quantities by Mr. T. Westcombe and Mr. Backhouse. The former gentleman, under date "Clova, July 23, 1852,"

writes as follows:—"Herewith I forward a sample of a certain fern, common in this district, and which I consider is the Polypodium alpestre. I found it in Canlochen and also in Glens Prosen and Fiadh; and it is commoner than Athyrium Filix-femina, and varies much in size, from four inches to three feet in length. When large it has quite the appearance of Athyrium Filix-femina, and when small and in fructification looks more like a Cystopteris." Mr. Backhouse, in a communication dated September 13, 1852, writes thus:—"After Thomas Westcombe, of Worcester, left us, we continued to find Pseudathyrium alpestre in all the corries of the Dee-side mountains, and those of the neighbouring districts. It was often mixed with Athyrium Filix-femina, at an elevation of from 2000 to 3000 feet; but from 3000 to 4000 feet Filix-femina had ceased and Alpestre was plentiful. In damp gorges, and among tumbled rocks, it was often destitute of fructification; but in more open places it was abundantly in fructification, varying from six inches to three feet four inches in height."

I have seen the Alpine Lady Fern growing most luxuriantly in an open border in the usual bog-earth used for American plants. In a green-house I find it flourishes in the same soil, but it should always have a large pot, and be frequently watered; it does best without a saucer, as I find that water standing about its roots is very apt to prove fatal.

31. FLEXILE LADY FERN. Flexile.

Pseudathyrium flexile. *B. F.* 203.

The caudex is massive, enduring, its position erect, its crown broad, gibbous, scaly: fronds without a stalk, linear, lance-shaped, very elongate, very attenuate, very flexile; pinnate; pinnæ short, gradually narrowed, rather blunt, rather distant, deflexed, pinnate, about fifteen pairs before they lose their distinctness at either extremity; those towards the base gradually diminish in size as well as length, and finally become almost rudimentary, though their divisions are not proportionately diminished in number: pinnules distinct and apparently separate, yet certainly connected by the wing of the midrib: there are seldom more than five pairs of pinnules before their distinctness is lost in the apical portion of the pinna; they are narrow at the sessile base, and slightly broader upwards nearly to the tip, so as to render the circumscription of each pinnule obscurely pear-shaped or obovate; on each side they have usually three strongly developed ascending teeth, and are also two- or three-toothed at the tip; the teeth themselves are also, in some of the most luxuriant and most developed specimens, bifid: the midvein in each pinnule is distinct and slightly waved: the lateral veins are alternate, unbranched,

and each bears a circular mass of seeds half-way between its base and tip: scales small, concolorous, pale brown, scattered sparingly over the general and partial stems, but, as usual, larger and more numerous towards the base of the frond. In all the specimens I possess the fronds are without seed at the tip, and profusely seeded at the base, a character which at once distinguishes this from any other British fern. In size this fern is rather diminutive; its fronds frequently attain a length of twelve inches, but its average length is seven: it fruits freely, even when not more than three inches in length. Great pains have been taken to discover abnormal forms, or any form that would indicate an approach to described species, but it is remarkably constant in all its characters. Flexile has been referred by speculative botanists to Filix-femina, Alpestre and Fragilis, but those who are practically acquainted with it, without exception, consider it a distinct species.

Hitherto found only in Glen Prosen, in Forfarshire, by a party of botanists, consisting of Messrs. James Backhouse, Thomas Westcombe and James Backhouse, jun., to all of whom I am indebted for the opportunity of examining a series of specimens. In this locality it appears to be most abundant, and doubtless will be found generally distributed, like the Alpine Lady Fern, over the Highland glens of Scotland.

In cultivation this beautiful and remarkable little fern should be planted amongst pieces of stone, and with the crown kept well above the surface: the best soil is a sandy peat: it will not bear a saucer, as the fronds and caudex are extremely liable to decay from the application of too much moisture. I have seen it growing in bog-earth in an open border, but I believe this is by no means commonly the case.

32. HUDSON'S SPLEENWORT. Lanceolatum.

Asplenium lanceolatum, *Hudson*. *B. F.* 219.

The radicles are black, very long, slender and penetrating; in the fissures of rocks they penetrate to a great depth, and the caudex becomes so completely and firmly wedged that it is often a task of great difficulty to obtain a living plant from such situations. The caudex is brown, tufted, and densely covered with bristle-like scales; similar scales are also scattered here and there on the stalk. The young fronds make their appearance in May, arrive at maturity in August, and remain uninjured throughout the winter; and, excepting in seedling plants, they are always fertile. The form of the frond is various; in some situations it is of erect growth, nearly linear, and simply pinnate, the pinnæ being stalked and lobed: in this state seed is abundantly produced,

and the masses, when full grown, are perfectly circular. A second form, of pendant growth and larger size, is more lance-shaped: the pinnæ are pinnate: the pinnules stalked, toothed, and somewhat quadrate: the fronds often measure a foot in length, and sometimes fifteen and even eighteen inches: they usually issue from dark holes or crevices, or depend from the roof of sea-caves, and the lower pair of pinnæ are often bleached, of small size, weak and imperfect: the surface of the frond is generally flat. A third form is of nearly erect growth, but bends over at the extremity; and the entire frond, together with each individual pinnule, possesses such rigid and inflexible convexity that it is next to impossible to flatten it by pressure. The lateral veins are branched, a branch running to the extremity of each tooth: the masses of seeds are attached near the extremity of the veins, and somewhat alternately, one branch bearing a mass and the next being without one: each mass is at first elongate and linear, and covered by a linear white involucre; this involucre soon disappears, and the masses generally become nearly circular and somewhat crowded: they are sometimes so large and crowded when ripe as to be quite confluent.

The European range of Lanceolatum is very limited. It certainly occurs in Sicily, Italy and Portugal, but I do not feel certain of other recorded localities. Mr. Watson informs me that he found it in Fayal, one

of the Azores, and I possess specimens collected in Madeira. It has been found somewhat abundantly in the South of Ireland. In Great Britain its range is extremely limited, and its localities strangely diversified as regards altitudinal and geological conditions. It is entirely absent, as far as my information extends, from Scotland and North and Central England. The following localities may be relied on:—In Caernarvonshire, near Llanrwst, on rocks near Tremadoc, and plentifully on Carry-y-Imbill, a bold and almost insulated rock at the entrance of Pwllheli Harbour: in Merionethshire, abundantly on an old wall and on rocks between Dolgelly and Barmouth, also at Barmouth; on the road between Tan-y-Bwlch and Aberglaslyn, also at Aberglaslyn: in Pembrokeshire, on Ramsay Island, opposite St. David's: in Gloucestershire, at Stapleton, three miles from Bristol: in Devonshire, at Morwell Rocks, on the banks of the Tamar; rocks on the Tavy opposite Virtuous Lady Mine; rocks near Cann Quarry, and on a mud wall near Buckland Monachorum: again near Tavistock; and by the sea at Salcombe: in Cornwall, it is most abundant near Penzance and St. Ives: it is found more sparingly at the Manacles, the Logan Rock, and on St. Michael's Mount: in Sussex and Kent, where these counties unite at Tunbridge Wells, I have gathered it in both counties: I mention these localities as reliable because I have gathered or seen the speci-

mens, but I am sorry to say so few botanists can appreciate the difference between this species and the next following, that I have thought it the safer way to omit all the records that have been obligingly handed me if unaccompanied by specimens.

In a common flower-pot this fern grows most luxuriantly. Select a small pot, in proportion to the size of the plant, fill the bottom to the depth of two inches with small pieces of charcoal; then prepare a mixture of charcoal, in pieces not larger than a hazel-nut, clean silver sand, fibrous peat chopped in small pieces, sandstone in small pieces, and light friable loam sifted fine, so as to get rid of the pebbles which so frequently occur in loam: these five ingredients, in equal parts, should be thoroughly mixed and passed through a coarse sieve. Hold the fern in the middle of the pot, with the rootlets spread as widely and loosely as possible, and with an iron spoon fill in the mixture carefully and equally, shaking it gently down until the pot is full. Stand the pot in a saucer constantly full of water, but supply no water on the fronds or surface soil.

33. BLACK SPLEENWORT. ADIANTUM-NIGRUM.

Asplenium Adiantum-nigrum, *Linneus*. *B.F.* 225, 227.

The caudex of Adiantum-nigrum is tufted, black, and covered with narrow scales: the stalk is extremely smooth, shining and generally of a black or dark purple colour; at its base are a few scattered pointed scales. The fronds seldom appear before the end of May or the beginning of June; at first their position is nearly erect, but they soon begin to droop, and finally become quite pendulous; they arrive at maturity in October, and remain perfectly green and vigorous throughout the winter, and until the ensuing May or even June: they are nearly always fertile. The form of the frond is triangular, its tip being acute and attenuated: it is pinnate: the pinnæ are triangular, acutely pointed, pinnate and alternate: the pinnules again are alternate and triangular, and the lower ones often pinnate or pinnatifid, with the lobes notched; the tips of the ultimate divisions are toothed. The lateral veins in the pinnules or lobes, as the case may be, are irregularly alternate, and are generally forked after leaving the midvein; and one or both branches of this divided vein bears on the side a line of seeds; these are at first covered by a white, linear, narrow scale-like involucre, also attached to the side of the veins: the

masses of seeds, together with their involucres, are situated rather nearer the midvein than the margin, and the involucres open towards the midvein. As the seeds advance towards maturity, the involucre is lifted up and pushed away from its original situation, and finally entirely disappears; the masses then become confluent, and their form is lost. This fern varies greatly in the amount of cutting or division of the frond; but these discrepancies seem to be the result of external circumstances, and not of constitutional difference.

It has been found in every country of Europe, in North and South Africa, in Madeira, Teneriffe, and many other Atlantic islands. A species very similar to the common English form of this plant has been discovered in the United States, but is of such great rarity that the opportunity of forming an opinion on the subject, from a careful comparison of a sufficient number of specimens, has not yet been afforded me.

This is a very ornamental fern for rockwork and walls. It is remarkably enduring and long-lived when in the open air in the country, but it dwindles in a London atmosphere, and does not like the confinement of a green-house, much less that of a Wardian case: in the former I have often found it dying without any apparent cause, and in the latter I have never known it to thrive. The best mode of cultivation, where the atmosphere is tolerably pure, is to plant it among

stones on a declivity facing the north, and also shaded by nut-bushes; the soil is a matter of no great moment, but it may be observed as a rule, that light sandy soils are better than heavy clayey ones. In a green-house, care should be taken to supply it constantly, but not immoderately, with moisture. The caudex will survive a good deal of drought and a good deal of moisture; but the fronds are soon affected by both, especially by the latter; they turn black, rot and die; black spots suddenly appear, increase and eventually cover the frond, as observed so frequently in potatoes. Other ferns are subject to this decay, but no other exhibits it so frequently. The soil should be chiefly composed of sand, and small lumps of sandstone should be interspersed.

34. BORY'S SPLEENWORT. Acutum.

Asplenium acutum, *Willdenow.* *B. F.* 231.
Asplenium productum, *Lowe.*

The caudex is robust, its crown composed of a mass of nearly black bristle-like scales, which totally hide the undeveloped fronds: the stalk is glabrous, very black at the base, very much longer than the leafy part of the frond, often more than twice as long; the leafy portion of the frond is very ample, elongate-triangular, the tips of the pinnæ, as well as the tip

of the frond, being excessively pointed: the frond, as well as its pinnæ and pinnules, are all pinnate, so that it is one of the most divided of British ferns: the ultimate divisions are linear, toothed and sharp-pointed; they seem to consist of a midvein and a narrow wing: the masses of seeds are linear; the involucre is also linear and very distinct: the dorsal surface is green and glabrous, and has the texture very peculiar, having a feel like that of writing-paper.

This exquisitely beautiful fern seems to be very abundant and very luxuriant in the Azores, the Cape de Verde, Madeira and Canary Islands; it also occurs, but less plentifully and less luxuriantly, in Portugal. In Great Britain it is unknown, and it has only been recorded for three Irish counties, Down, Kerry and Cork. In the Killarney district it occurs in company with the Black Spleenwort, but the two species remain perfectly distinct.

I have scarcely any practical experience of this fern under cultivation: its natural conditions may perhaps be best imitated by covering it with glass, and thus affording it that atmospheric moisture which, in the Atlantic Islands and in Ireland, tends to produce and mature such delicate species as the filmy ferns.

35. SEA SPLEENWORT. Marinum.

Asplenium marinum, *Linneus*. *B. F.* 235, 239, 240.

The caudex is tufted, its crown black and covered with bristly scales: the fronds make their appearance in June and July, ripen their seed in October and November, and remain perfectly green throughout the year; in August the fronds of two seasons are equally vigorous, the younger ones being distinguished by their paler colour and immature fructification. The stalk is generally scarcely a third as long as the leafy portion of the frond, which is linear and simply pinnate: the pinnæ are attached by their midrib; their forms are various, but they are generally oval, and the edges slightly notched; one or two pairs larger than the rest frequently appear near the tip: the pinnæ are connected by a narrow wing running along the main stem. The lateral veins are forked almost immediately after leaving the midvein; the anterior branch bears a long linear mass of bright rust-coloured seeds: each of these masses, when young, is covered with a white membranous involucre, of similar form, which always opens towards the tip of the frond.

The Sea Spleenwort, as its name implies, is essentially a sea-coast species, sometimes rooting deeply

in the fissures of sea-cliffs, sometimes clothing the roofs of sea-caves with a drapery of green. It occurs luxuriantly in the Islands of the Atlantic, has been found on the Atlantic coast of Africa opposite the Canary Isles, and very sparingly on the Atlantic coast of Spain and France. In Great Britain it is found here and there round the greater part of our sea-board; one long interval, however, occurs in which it has not been seen, namely, on the east coast from the Castle Rock at Hastings to Scarborough. Beginning then at the Castle Rock, we find a few plants maintaining a very precarious existence; proceeding westward, a good many plants may be found in the Isle of Wight among masses of rock above the shore west of St. Catherine's Point, beyond Knowle towards Blackgang. In Dorsetshire, on rocks in the Isle of Portland; in various places at Purbeck, and also near Lyme Regis. On the south coast of Devonshire it is comparatively common at Babbicombe, Dawlish, Teignmouth, Exmouth, Torquay, and other places; Livermead, Daddy Hole, Mead Foot and Hope's Nose, all near Torquay, are particularly mentioned. In Cornwall it occurs all round the coast: the finest English specimens I have seen are from St. Ives and Mousehole. On the north coast of Devonshire it is found at Ilfracombe: in Somersetshire, at Weston-super-Mare and Clevedon. In Glamorganshire it occurs near Neath; also at the Mumbles Lighthouse;

between the Mumbles and Penyard Castle; near Swansea, near Dunraven, near Oystermouth, on Barry Island, and plentifully in Bacon's Hole: in Pembrokeshire, between Tenby and Saundersfoot, in deep fissures of the rocks, at Fishguard, and in caves and cavities of the old red sandstone near St. Justinian's Chapel, St. David's, &c., &c.: in Cardiganshire, on the Castle and Castle Rock, at Aberystwith: in Merionethshire, at Towyn: in Anglesea it is not uncommon, but occurs on most of the rocks, Prudholm Island, the South Stack, &c.: in Caernarvonshire it occurs on the Eagle Tower, Caernarvon Castle, and on the Orme's Head. In Cheshire, at Hilbre Island, at the mouth of the Dee, in great quantities; also at the Red Noses, in the Mersey: in Lancashire, at the celebrated Wynwick Stone Quarry, quite inland; at Knot's Hole, near Liverpool; near Newton; and abundantly on rocks near Heysham, and in a cave at the head of Morecambe Bay: in Cumberland, at Whitehaven and St. Bees' Head. In Scotland it grows freely on the Atlantic coast, and on the Isles of Mull, Iona, Staffa, &c. I saw it growing abundantly intermixed with Ruta-muraria and Adiantum-nigrum, on the old Cathedral, at Iona: on the eastern coast of Scotland it is comparatively rare; but it reappears in some plenty in Durham, on Marsden Rocks, near Hartlepool, and near Southwick, and finally at Scarborough, in Yorkshire. In Ireland, the Atlantic coast

produces the Sea Spleenwort most abundantly; the localities south, west and north are too numerous to mention: I must, however, notice one locality that struck me as remarkable, namely, the Lakes of Killarney; here I found it in 1839, and here it continues to exist in 1863: as you skirt the Upper Lake, on the way to Kenmare, there is a spot where the rock, at that time (1839), appeared to have been recently blasted with gunpowder, for the purpose of making a good carriage-way between Tork Mountain on the left and the lake on the right: on this rock it has thoroughly established itself, probably proving, as some able geologists suggest, that the beautiful Lakes of Killarney formerly formed an arm of the sea: the Sea Spleenwort here is of small size and rather remarkable form, and is not procured without trouble, the face of the rock being difficult to climb, and the little ferns being very firmly rooted in the fissures.

This is a most difficult fern to deal with in cultivation, unless carefully protected from exposure: it will thrive luxuriantly in a stove-house, with a moist heat of 70° Fahrenheit, but dies on rock-work, even in the purest air, if denied the advantage of the sea-breeze: this is the more remarkable, since at Newton, Warrington and Killarney, as recorded above, it has voluntarily forsaken the vicinity of the sea. Mr. Wollaston gives me the following directions for cultivating this fern:—"The soil should be composed of sandy loam

and turfy heath-peat, with a small portion of thoroughly rotten leaf-mould, and it *must* be kept in a greenhouse, or in a frame, or covered by a hand-light." Mr. Wollaston, however, suggests to me that it might be planted between pieces of stone on rock-work, with a southern aspect, and in a very sheltered situation, protected completely from every ray of sunshine. I find this plant invariably killed by severe frost. In many of its native localities the Sea Spleenwort is so firmly fixed in the fissures of the rock as not to be removed without the greatest difficulty, and rarely without the danger of inflicting some fatal injury on the caudex and roots: in other localities it roofs the sandstone caves, spreading its roots like a carpet over the soft sandy surface, and may be removed with the greatest ease; when obtained from such localities its cultivation is comparatively easy.

36. GREEN SPLEENWORT. Viride.

Asplenium viride, *Hudson*. *B. F.* 243.

The caudex is black, scaly and tufted: the fronds appear in May and June, and, arriving at maturity in August, remain green throughout the winter; they are always fertile. The stalk is half as long as the frond; the basal portion is black or purplish, the remainder is of a vivid green: the leafy portion of the

frond is narrow, long, linear and simply pinnate: the pinnæ are quadrate, or perhaps more correctly lozenge-shaped, but without angles, and are more or less notched at the edges; they are for the most part placed alternately, and are generally very distinct and distant, but I have seen them crowded, especially when the plant has been starved; they are attached to the main stem by their stalks only. The lateral veins are either simple or forked; they bear a long linear mass of seeds, and when forked the mass is most invariably situated before the fork: this appears to me a very excellent distinguishing character, and one by which this species may readily be known from the following: some of the veins reach the edge of the pinna. The masses of seeds are at first covered by a long white involucre, which soon disappears, and they become a bright rust-coloured confluent mass occupying the middle of the pinna, and concealing the midrib: the masses before their union are usually six in number.

The Green Spleenwort is found in all the countries of Europe, but I have not heard of its occurrence on any other continent. It is a beautiful little fern, delighting in wild hilly countries, and shunning the vicinity of man. It is found chiefly in the fissures of rocks, when sheltered growing to a length of eight inches, but when exposed seldom measuring more than two. My late brother, who, as an invalid, resided at Grasse, in the South of France, wrote to

me that near that town he found it growing on hedge-banks, exactly as Trichomanes does in this country: the specimens were correctly named, and I have received similar information from Professor Duval-Jouve, of Grasse. As the climate is peculiarly mild and the altitude of Grasse but little above the sea-level, this habitat seems at first rather abnormal; but this, as well as other facts connected with its singular habitats, may perhaps lead to the conclusion that the geographical distribution of this pretty little fern is governed by some geological law rather than one of climate or altitude. In England I have found it growing in considerable abundance on an old garden wall at Mickleham, in Surrey; a fruit tree is trained on the wall, and the green fronds of the fern are intermixed with the leaves of the tree. The garden in question is occupied by a trainer of race-horses well known to the dwellers in this pretty village: it occurs in a similar locality at Danny, near Brighton; and also formerly in Mr. Owen's garden at Maidstone, in Kent. In Worcestershire, it occurs in a very starved and diminutive state on Ham Bridge, near Sapey Brook, in the valley of the Teme: when I last visited this district the fern still existed, although the bridge had been recently pointed. In Derbyshire, Staffordshire and Lancashire it grows very sparingly, but in more natural localities: more plentifully at Dulesgate, in Lancashire; at Settle, Halifax, Aix-la-Beck, Richmond and Gordale, in York-

shire; on Falcon Clints, Durham; on Hutton Roof, Farlton Knot, Arnside Knot, Casterton Fell and Mazebeck Scar, in Westmoreland; at Ashness Gill, Borrow Force and Rocks at Gillshead, in Cumberland; and on rocks by the Irthing at Wardsea, in Northumberland. In Wales I have found Viride in abundance at Llyn-y-cwn and Llyn Idwel, in Caernarvonshire: in Brecknockshire, it occurs near the town of Brecon, also on the Brecon Beacon and the Trecastle Beacon; and at the cascade called Scwyd-yr-Henryd, near Capel Colbren, it is plentiful on rocks below the fall, and there is at this spot a very old trunk of mountain ash covered with a drapery of this fern; in Glamorganshire, it grows on rocks at the upper Cilhepste Waterfall, at Darran-yr-Ogof, and at Merthyr Tydvil. In the Highlands of Scotland it is comparatively common, but in Ireland it is very rare: Bandon, in the County Cork; near Lough Eask, in the County Mayo; Tork Mountain, in the County Kerry; and Ben Bulben, in the County Sligo, are the only localities with which I am acquainted.

This fern is easy of culture in the open air, provided the soil be light and the atmosphere humid. In a green-house it is very uncertain, thriving well for the first or perhaps the second year, but afterwards refusing to renovate its fronds, from some inexplicable cause. A compost consisting of chips of micaceous rock, sand, peat, and a slight admixture of thoroughly decayed

leaf-mould, seems best adapted to its requirements: it also needs good drainage, and likes to be covered with a bell-glass. When successfully grown it is a very pretty plant, but I regret to say that its usual appearance is shabby and ill-conditioned.

37. MAIDENHAIR SPLEENWORT. TRICHOMANES.

Asplenium Trichomanes, *Linneus*. *B. F.* 249, 252.

The radicles are black and wiry; they insinuate themselves into the fissures of rocks, previously so small as to escape observation: in old buildings this fern certainly promotes decay by disintegrating the mortar, which, however enfeebled by time, still adds in some degree to their strength and durability. The fronds make their appearance in April and May, arrive at maturity in August and September, and remain perfectly green throughout the winter. The stalk is about a third as long as the leafy part of the frond, smooth, shining, and, although green at first, eventually becomes nearly throughout its whole length of a purplish black colour. The frond is narrow, linear, and simply pinnate: the pinnæ are dark green and very numerous, irregularly ovate, obtuse at the tip, and more or less crenate at the margin: they are usually distinct and distant, but are sometimes crowded, and each more or less overlaps the one

preceding it; they are attached to the stalk by their midrib only, and when the frond approaches decay, the pinnæ fall off like the leaves of trees, leaving the stalks quite naked; these are very durable, lasting from year to year, and become a dense tuft of bristles. The lateral veins are forked soon after leaving the midvein, the anterior branch bearing a linear mass of seeds almost immediately after the division: this mass is at first covered with a long, linear, white, membranous involucre; as the seeds swell, this involucre becomes obliterated, and the masses, which are dark brown, become nearly confluent in two series; these, however, very rarely unite over the midrib: the masses are about twelve in number.

This beautiful little fern is found in every country of Europe, in Africa, in the Islands of the Atlantic, where it is called Asplenium anceps, and in North America, where it is called Asplenium trichomanoides. It occurs generally throughout England, Wales, Scotland and Ireland, growing on rocks, walls, churches, bridges, banks, and especially the banks of hedge-rows. It is more common in the western than the eastern counties, and although it occurs occasionally in localities "few and far between," it must be considered an extremely rare fern in Essex, Norfolk and Suffolk; a few plants occur on Hadstock and Bishop's Stortford Churches, both in Essex. At Churt, near Godalming, in Surrey, a large and very beautiful form of this fern

clothes a hedge-bank for more than a hundred yards, with scarcely any admixture of other plants. In the West of England, and especially in Wales, it is a common fern: I once saw it in such profusion on a little bridge at Bualt, in the Valley of the Wye, that it formed a continuous covering of green, and presented a very beautiful appearance. There is scarcely anything in the vegetable world more lovely than such a scene as this; and it is only known by those who have tried the experiment, how readily and exactly it may be realized in any of our gardens.

Being a hardy plant, and very patient of cold or heat, drought or moisture, it is readily cultivated, especially on an artificial wall built with a northern aspect.

38. PETRARCH'S FERN. Asplenium Petrarcæ.

Asplenium Petrarcæ, *Bory.*

Caudex small, tufted, the crown covered with dark-coloured, linear, sharp-pointed scales. Frond, including the stalk; three inches in length, the naked part of the stalk about three-quarters of an inch, and purple-brown, which colour ascends to the third pair of pinnæ: the leaf part of the frond less than half an inch wide, and diminishing to a very sharp tip; pinnate; the pinnæ are opposite at the base, short-stalked, obscurely triangular, and divided by deep

notches into three or five lobes, all of them rounded, blunt and delicately crenulate at the edge; but above the middle the pinnæ become alternate and oval, without any division into lobes, the edges being still delicately crenulate; veins generally three, sometimes five, all running together into the foot-stalk of the pinna; the middle one again divided; each vein bears a linear mass of seeds on its side, and each of these masses is covered with a narrow, linear, white involucre, the free edge of which is quite smooth; in the lobes, these involucres open towards each other, face to face: as the seeds advance towards maturity they entirely cover the under surface of each pinnule, and are of a rich brown colour.

This fern was found by M. Gittard in Greece; Gussone observed it in two or three localities in Sicily, as the Madonie Hills at Scatamodaggio, also at Pietra Fucile, and on the rocks at Daini: other specimens were found in the same localities by Todaro, and on the calcareous rocks of the Sierra Vernisa, in Murcia, by Bourgeau. I am indebted to Lord Clermont for specimens collected by Lady Clermont near Flurry Bridge, in Ireland: her ladyship has thus added this beautiful little species to our list of British Ferns.

Of its culture little can be said at present: I should recommend the same mode as with Ruta-muraria, between which and Trichomanes it is precisely

intermediate in habit and form, and will be reputed a variety of either by those who are unacquainted with European species.

39. RUE-LEAVED SPLEENWORT. Ruta-muraria. WALL RUE.

Asplenium Ruta-muraria, *Linneus*. *B. F.* 253, 256.

The caudex is black, tufted, and clothed with bristly scales: the fronds make their appearance in May or June, arrive at maturity in September, and continue perfectly green throughout the winter, and until the ensuing May: they are always fertile. The stalk is black or dark purple, very smooth and shining, and generally longer than the leafy part, the normal form of which is triangular and pinnate; the pinnæ being alternate and also pinnate: the pinnules are of varied form, but mostly somewhat diamond-shaped; they are stalked and resemble so many little leaves; their exterior margin is generally toothed. The veins radiate from the stalk to the outer edge of the pinnule, and to them are attached the elongate lines of seeds, two, three, four and even five on a pinnule: these are at first covered by an elongate, linear, white involucre, the free margin of which generally faces the median line of the pinnule, and is jagged and uneven; this is soon pushed aside by the swelling

seeds, turned back, and finally lost, the back of the pinnule becoming eventually nearly covered by a dense, dark-brown mass of seed.

The Wall Rue is generally distributed over the continent of Europe, preferring towns and buildings to the open country. I have also specimens from North America. Throughout the northern, western and southern counties of England, and also in Wales, Scotland and Ireland, this fern is to be found on almost every ruin; but, as regards England, far less abundantly in the eastern than in the western counties. In a perfectly wild state, it grows abundantly on the rocky hills in Scotland, particularly on Arthur's Seat, near Edinburgh; in the Peak district of Derbyshire; on Cader Idris and Snowdon more sparingly. It is one of those plants which, like our half-domesticated birds, the sparrow, the swallow and the martin, seem to have deserted their native wilds, and to have taken up their residence amongst the habitations of men. It is abundant on ruins and old churches, and has a strong predilection for brick walls, notwithstanding Sir J. E. Smith, on the authority of Ray, expresses a different opinion. So carefully observant a man as Ray must have frequently seen it flourishing in the crumbling mortar filling the interstices of brick buildings: we need wander no further from London than Greenwich Park to see it growing abundantly upon bricks: and nothing can be more common than to see it on the

brick walls of fruit-gardens, particularly selecting the uppermost line of mortar, which may perhaps be protected by a coping of brick: this is ever a favourite station for cobwebs and Wall Rue.

The Wall Rue is a difficult plant to cultivate; it seems to disapprove of the attentions of the gardener, to loathe his waterings and his syringings, to despise his composts, and utterly to eschew the confinement of a bell-glass. Out of doors, the Wall Rue succeeds best on a garden wall; in doors, it must be kept in a well-ventilated green-house, and planted in a small pot filled with broken brick and old crumbled mortar: water should be supplied very sparingly. It may be observed that the want of success which ordinarily accompanies the attempt to cultivate this little fern is often attributable to injuries inflicted on the roots and rootlets in removing the plants from their original localities; great care should therefore be taken in conducting this difficult process: if permitted, it is best to remove the bricks one at a time, and to replace them as soon as the ferns are secured.

40. WEISS' SPLEENWORT. GERMANICUM.

Asplenium germanicum, *Weiss.* *B. F.* 258.
Asplenium alternifolium, *Wulfen.*

The caudex is tufted: the stalk dark brown at the base, but green above: the frond is very narrow, linear and pinnate: the pinnæ are few in number, alternate, distant, ascending, somewhat curved, the convexity of the curvature being outwards, the concavity towards the stalk, bifid or trifid at the tip, and occasionally toothed or lobed on one or both sides: the united apical portion of the frond is generally larger and also more pointed than either of the pinnæ, and is of uncertain shape, being dissimilar in different fronds of the same plant: the pinnæ, as in the last species, are without a midvein; they have two, three or four subparallel, longitudinal veins, and on each of these is usually situated a line of seeds, which, as far as I have observed, is covered by a linear, somewhat inflated and persistent involucre, which is slightly arched over the seeds, opens towards the median line of the pinna, and has a sinuous but not jagged free margin.

This little fern is nowhere common, but occurs here and there on walls and rocks in Sweden, Hungary, Germany, France and Italy. I have seen no specimens from beyond the limits of Europe. It

is one of the very rarest of our British Ferns: six localities only are recorded, two English, one Welch and three Scotch. In Ireland it is unknown. The Scotch localities are as under:—1st. About three miles from Dunfermline, in Fifeshire. 2nd. On Stenton Rocks, near Dunkeld, in Perthshire. This locality has previously been recorded, but the plant was supposed to have been extirpated for many years, when I received the following note from Mr. G. Smyttan, of C. C. College, Cambridge:—"After reading your remarks on Asplenium germanicum, I have thought it might be interesting to you to know that I have a specimen of this very rare plant, gathered on Stenton Rocks so lately as last summer. After two hours' climbing on the bare rocks, on one of the most burning days, I at last found the treasure in a fissure of the barest part of the rock." 3rd. On some sunny rocks about two miles from Kelso, on the Tweed, in Roxburghshire. In England the localities are—1st. On Kyloe Crags, in Northumberland. Mr. Tate, the discoverer, writes, "These crags are chiefly composed of rudely columnar basalt, resembling the trap range of Salisbury Crags. Sandstone crops out from beneath this, and at the western end forms a steep cliff. After botanizing for a short time, I had the good fortune to find Asplenium germanicum growing sparingly upon the basalt. It is not a fern easily passed by: its pale green fronds at once attracted my

attention, and a closer examination readily enabled me to determine its species. The few specimens I observed were remarkably luxuriant, so much so, indeed, that I counted upwards of thirty fronds growing on a single root. There appeared to be no possibility of the plants having been introduced. This Asplenium is most nearly allied to Ruta-muraria, from which, and from other species of the genus, it is distinguished by its alternately pinnate frond, narrow, wedge-shaped pinnules, and entire involucre. Some regard Asplenium germanicum as a variety of Ruta-muraria; but, as the latter does not occur at Kyloe Crags, or in their vicinity, the supposition is by no means probable. Septentrionale still exists in considerable abundance on the high and exposed portions of the Crag, as well among the *débris*." 2nd. In Cumberland. The first record of the occurrence of Germanicum in England is by Mr. H. E. Smith, in a note addressed to myself. "Asplenium germanicum," says Mr. Smith, "has been noticed in this neighbourhood, and, as far as I am aware, this is the first recorded English locality. It was found in the summer of 1846, by William Greaves and Joseph Flintoft, the latter of whom executed the famous model of the Lake District; it was growing in the cleft of a rock in the wilds of Borrowdale." In September, 1852, Miss Wright rediscovered this fern, I believe, in the same station, and obligingly sent me a specimen, accompanied by the following note:—"I

take the liberty of enclosing a specimen of Asplenium germanicum, which I have found, while looking for A. septentrionale, on high rocks in Borrowdale." Miss Wright's specimen was correctly named; and Mr. Borrer, writing to me, under date of November 22, 1853, says, "Miss Wright showed me a living plant of Asplenium germanicum, and Mr. Flintoft some dried fronds, which they stated to be brought from different spots in Borrowdale. Miss Wright conducted me to the spot whence she 'brought' her plant, but neither on that occasion, nor on previous visits, did she find a second root." The discovery of Germanicum in Wales was first recorded by myself in the 'Phytologist' for October, 1847. "Three years have elapsed since I received an anonymous letter, beginning thus, 'A lady who has this season visited North Wales,' &c., and then stating that she had found Asplenium septentrionale in great abundance, and also unmistakeable specimens of Asplenium germanicum: the locality was carefully and obligingly given, with the view of conducting me to the spot. As far as regarded Septentrionale, I knew the statement to be correct, and had no reason whatever to doubt the more extraordinary fact of Germanicum having occurred in Wales, other than the feeling of uncertainty whether the nameless lady knew the plant which she so called. The matter is now set at rest; I have before me a veritable specimen of Asplenium

germanicum, gathered (at the very station pointed out by my anonymous correspondent) by Mr. W. Wilson, of Warrington." Subsequently, the late William Williams, the Snowdon guide, found a root of this rarity on Moel Lechog, a precipitous rock to the right of the Pass of Llanberis, as you look towards Capel Cerig. This plant was transmitted to the Royal Botanic Garden at Kew, where I saw it some time ago, and where perhaps it is still living.

This little fern is common in cultivation, but, generally speaking, is not long-lived. It is cultivated with more success on the Continent, especially in Germany and the South of France, where it is sought for with avidity, owing to its high money value, and is freely imported by our nurserymen. It should be planted between fragments of freestone, in a soil composed of peat and thoroughly decayed vegetable mould; the latter in small quantities. Great care should be taken that the water be supplied moderately, and none should be allowed to stagnate about the roots.

41. FORKED SPLEENWORT. Septentrionale.

Acrostichum septentrionale, *Linneus.* *B. F.* 265, 269.

The radicles are very long, numerous, fibrous and interlaced, and, together with the caudex, which is large and tufted, often form an amazing bulk, when we consider the small size of the fronds. The fronds are very small, two or three inches long, and very narrow, scarcely more than a third of an inch in width; their form is elongate and almost linear, there being no perceptible division between the leafy part of the frond and its stalk, the leafy part narrowing very gradually into the stalk, which is smooth and black at the extreme base; the sides of the frond have two or three bifid teeth on each side, and the tip is also generally bifid. The veins are nearly simple, and few in number, one running into each tooth; the seeds are attached to each vein in a continuous line, covered by a narrow white involucre, which opens towards the middle of the frond, and, as the seeds swell and advance towards maturity, this involucre is thrown backward, finally lost, and the under side of the frond then presents a continuous mass of brown seeds; the edge of the involucre is waved, but not jagged. This little fern

is extremely different from our other British species; but, on the other hand, it is extremely similar to a small flowering plant called Buck's-horn Plantain, or Plantago Coronopus, indeed so like as to be readily mistaken for it. Although occasionally occurring in lofty and exposed situations, it can scarcely be considered a hardy species, since it is very susceptible of cold, its young fronds being destroyed by a very slight frost.

The Forked Spleenwort occurs very abundantly in Hungary, Italy, Spain and the South of France, and is recorded as an inhabitant of Lapland, Sweden, Denmark and Russia; in the north, however, it seems rare, in the south comparatively common. It is one of our rarest British Ferns, occurring only in the fissures of rocks and the interstices of stone walls; in the latter situation it appears to thrive more luxuriantly, probably from the frequently exposed position and elevation of the former. I have seen specimens from nearly all the recorded stations, and none equal in luxuriance to those I found on a wall by a farm-yard at Llanrwst, which being on the Conway, and near its mouth, cannot be elevated much above the sea-level: in this locality the tufts were enormously large, and one of them, which I took away, was so heavy that, even after shaking off all superfluous earth, I could scarcely carry it; this tuft, although probably consisting of a single caudex, had

upwards of three hundred perfectly vigorous fronds, besides a greater number of decaying ones, the produce of previous years. It occurs in four Scotch, six English, and two Welch counties:—Forfarshire; Edinburghshire, on Arthur's Seat; Roxburghshire; Perthshire, on Stenton Rocks; Northumberland, in the fissures of the columnar basalt of Kyloe Crags; Cumberland, on Honister Crags, on crags in the vicinity of Scaw Fell, in a ravine of the Screes near Wastwater, about six hundred feet in perpendicular height, and on rocks near Borrowdale; Westmoreland, mountains above Ambleside; Yorkshire, on Ingleborough; Somersetshire and Devonshire, plentifully on loose stone walls in the parish of Culbone, about six miles from the boundary line of the two counties, and at an elevation of 1000 feet above the sea level; also in equal abundance on a loose stone wall two miles north of the parish church of Oare (the localities are not confined to either of the two counties mentioned); Caernarvonshire, in the Pass of Llanberis on both sides of the Pass, on Moel Lechog, on rocks above Pont-y-Pair, on rocks between Bettws-y-Coed and Llanrwst, on a stone wall between Llanrwst and Conway, one mile from the former, and in twenty stations on the hills between Llanrwst and Conway; in Denbighshire, at Llan Dethyla, also near Llanrwst, but on the Denbigh side of the Conway. There is no recorded Irish locality.

Strictly evergreen, and very singular in appearance, this fern is well worth the trouble of cultivation. Mr. Wollaston says that it "not only requires very careful potting, but extreme care and attention afterwards;" a remark which I find very true. The plan recommended for the Wall Rue may be followed also with this species, always, however, bearing in mind that the loss of plants is much more difficult to repair. I prepare a number of thin pieces of freestone, and having placed them in an ordinary flower-pot in an erect position, introduce the rootlets of the fern between two of them, allowing the crown of the caudex to stand clear above them: the pieces of stone should then be wedged up firmly by introducing others at their sides, and a little sifted peat-earth and old mortar should be shaken into the crevices. Water must be used very sparingly.

42. HART'S TONGUE. Scolopendrium.

Asplenium Scolopendrium, *Linneus*. *B. F.* 271, 274, 275, 276.

The caudex is tufted, blackish and scaly: the young fronds make their appearance in April and May, growing in an erect position, and the tips remaining for some days very narrow and convolute; by degrees the fronds become horizontal, and at last

drooping, after the base of the frond has attained its full size; they arrive at maturity at the end of September, and continue in full vigour throughout the winter, and until those of the ensuing year make their appearance. The form of the frond is strap-shaped and quite undivided, pointed at the tip, and heart-shaped at the base: the stalk varies from a fifth to a third of the entire length of the frond; it is of a dark purple colour and rather scaly at the base: in some specimens, but these are generally young, the entire plant is hairy, in others perfectly smooth. The seedling plants put on a variety of forms. The veins proceed directly from the midribs, and each has four or five branches: to the outside branch of each vein, or system of veins, is attached a long line of seeds, covered by a white membranous involucre of the same form: owing to this disposition of the seeds on the outer branch of each system of veins, the masses are invariably in pairs; the two involucres at first meet and appear as one; a day or two later, as the seeds increase in size, a line appears between the two involucres, showing that they are divided; the line gradually becomes more apparent as the seeds increase in size; at last the two involucres are pushed back from each other, and finally disappear.

I believe this handsome species is found in every country throughout Europe, but is very sparingly distributed towards the North. It is said to have

been found in North America, but is there considered one of the rarest of ferns. I have seen no specimens from Asia, Africa or South America. The Hart's Tongue is a particularly ornamental fern; its habit is well marked, and very decidedly different from that of every other British species. I believe it is universally, though not abundantly, distributed in Great Britain, but it so frequently grows in the thickest part of hedges that it may readily escape observation, and thus does not appear so abundant as it really is. In Scotland I found it sparingly distributed, but I never passed a day without recognizing it in some few localities. In Ireland it is much more abundant: it is not only scattered generally over the island, but occurs in some localities in very great abundance, particularly in the neighbourhood of Sligo, and in the demesne of Muckross, near Killarney; here it grows among the underwood, in the shrubberies, &c., in large, luxuriant tufts, the fronds radiating from a common centre, and each being gracefully arched in a semicircle, like the long feathers of a cock's tail. The Hart's Tongue is very commonly found upon walls and ruins; and it seems particularly to delight in old wells, in which last situation its fronds sometimes grow to a very large size: in the celebrated well at Ludlow Castle, now very properly covered by an iron grating, it forms a very beautiful object.

The requirements of this fern are a free soil, shade

and moisture: it is very ornamental on a shaded rockery, but does not flourish well when exposed to sunshine.

43. SCALY SPLEENWORT. Ceterach.

Asplenium Ceterach, *Linneus*. *B. F.* 277, 280, 282.

The rootlets of the Scaly Spleenwort are short, but possess a remarkable power of penetrating mortar, however hard it may be; they even find their way into rocks which appear to present a compact surface; still, from the luxuriance of some plants kindly transmitted to me, it would appear that this species thrives much more vigorously in the rich vegetable mould which has been accumulating during centuries in the deeper fissures: here the rootlets are longer, but still appear short as compared with those of other rock-loving species. The caudex is tufted, brown and scaly. The young fronds make their appearance in May, and before unfolding are nearly white on the under side: they arrive at maturity in autumn, and continue green and vigorous throughout the winter: they are always fertile. The stalk is short and beset more or less thickly with pointed scales: the form of the frond is linear, slightly narrowed below, and deeply pinnatifid; the segments are short, rounded, and sometimes crenate or lobed; their position, as regards the

stalk, is rather oblique; their entire under surface is densely clothed with brown, pointed, imbricated scales, which, when examined under the microscope, are found to be very beautifully reticulated; these scales give a rust-coloured tint to the entire under surface. The midvein of each pinna is waved, but distinct: the lateral veins are few in number, alternate and irregularly branched, the branches occasionally uniting with each other before their termination: the anterior branch of each bears an elongate mass of seeds; these are situated about midway between the midrib and the margin of the pinna; the first anterior lateral vein usually bears two masses of seeds, one on each side of its principal branches; the seeds are attached to that side of the vein which is nearest to the middle of the pinna, and not on the back of the vein; it should, however, be observed that the seeds seated on the veins nearest the midrib of the frond are placed in a position opposite to that of the rest, and in this instance the opening of the involucre may be said to take place towards the stem. Immediately adjoining the attachment of the seeds, and also attached to the back of the vein, is an erect, white, very narrow, membranous involucre, exactly corresponding in length with the line of seeds with which it is connected. This is a microscopic object, and is merely mentioned for the sake of precision; it can only be detected by one who is expert in making such investigations.

The Scaly Spleenwort is found in all the middle and southern countries of Europe, but I believe it has not yet been discovered in Lapland, Norway, Sweden, or the North of Russia; it occurs in the South of Russia, both European and Asiatic: it is common in the North of Africa and in the Canary and Cape de Verde Islands. In Madeira and Teneriffe it also occurs, as well as a plant of much larger size than ours, and of more beautiful appearance, a plant which some botanists call Notolepeum aureum, while others believe it a variety of Ceterach; I cannot take upon myself to say whether the two forms are identical as species. It is very generally scattered over the northern, western and southern counties of England and Wales: in the midland counties it is of rare occurrence, and in the eastern scarcely known. In a few instances, more particularly in limestone districts, it is found growing freely on rocks, and in what may be considered truly natural situations; but its usual locality is the mortar of ruins, churches and walls, erected by man, and therefore not strictly natural; for when we provide a proper dwelling-place for plants or animals, whether intentionally or unintentionally, it always partakes more or less of an artificial character. A singular and quite abnormal dwelling-place for this fern is recorded by Mr. W. R. Smith: this gentleman found it growing with other ferns on an old tree overhanging a deep chalk lane at

Pitt, near Winchester. The English counties in which Ceterach is most abundant are Somerset, Gloucester and Westmoreland. In Scotland it is a fern of great rarity: it has been found sparingly at Kilfinnan, in Argyleshire; on Kinnoul Hill, in Perthshire; and near Paisley, in Renfrewshire. My kind correspondent, Mr. W. G. Johnstone, informs me it has been found in three different localities in Dumfriesshire.

This is a ticklish fern to cultivate, and succeeds best when planted in the interstices of a mortared wall, after the mortar has begun to crumble, but this only in a tolerably pure atmosphere; near London it soon dies. In pot culture much trouble is necessary: the soil should be prepared with great care, using one-third of old crumbled mortar, one-third of peat-earth, and one-third of limestone or oolite broken small: it should have but little water, and this little should never be allowed to stagnate about the roots: neither should any water be suffered to remain upon the fronds; for, although in a state of nature the plant seems to receive much nutriment through them, since its rootlets are scarcely accessible to the influence of rain-water, yet, in the still, water-laden atmosphere of a green-house, the case is different, the atmosphere itself conveying a supply that is abundantly sufficient; water from extraneous sources allowed to remain on the frond soon causes decay. Although this fern

will bear full exposure to the South, it attains greater luxuriance in a northern aspect, or when protected by artificial means from the rays of the sun.

44. BRISTLE FERN. TRICHOMANES SPECIOSUM.

Trichomanes speciosum, *Willdenow.* *B. F.* 283, 288, 292, 293.

Trichomanes radicans, *Hooker, but not of Swartz.*

The rootlets and creeping caudex of the Bristle Fern a good deal resemble those of the Common Polypody, but on a smaller scale: the rootlets are black and clothed with fibrillæ, which, like the claspers of ivy, adhere to the surface of rock: the caudex is brown, tough, tomentose and remarkably long; I have collected specimens which must have been many yards in length, and I observed that these root-like caudices formed a kind of net-work over the surface of a rock to which the real rootlets were adherent: this I found to be a character of the plant when most luxuriant, but I discovered other smaller plants possessing more rootlets and less caudex, and having the rootlets fixed in a thin layer of moist earth, among a profusion of moss and Filmy Fern. The young frond exhibits itself in a very rudimentary state in the autumn, and at any part of the caudex except its growing extremity; its full development is

not complete until the November of the following year, and it takes another year to produce seeds: the fronds usually endure for many years. The woolly covering of the caudex is found, under a lens of high power, to consist of jointed bristles, which are evidently analogous to the scales on the stalks of other ferns: they may be seen most abundantly on the young frond before it is unrolled, and found scattered here and there on the stalk after the frond has attained maturity: they are of a rich brown colour, the dilated portions being slightly transparent. Intermixed with these bristles are others, much finer, shorter, and more transparent; and these, under a lens of sufficient power, are also found to exhibit traces of joints: the woolly appearance of the rootlets is due to these minute bristles. The form of the fronds is between lanceolate and triangular, those from Glouin Caragh approaching the former, and those from Killarney the latter form: they are pinnate, the pinnæ being alternate and pinnate, and the pinnules deeply divided and pinnatifid: perhaps it would be more correct to describe the delicate but wire-like veins as thus divided, and to say that each of these veins is furnished on each side with a semi-transparent wing extending throughout its length: the entire frond is composed of these winged veins, and consequently all its divisions are narrow and linear: the wing extends also to the stalk, which is about

equal to half the leafy part of the frond in length. The fructification may be thus described: — The anterior branch of each set of veins passes beyond the leafy membranous wing, and looks like a stout bristle; the seeds are attached to every part of this bristle, arranged in regular, compact order along its sides, and one single seed, or, more properly, capsule containing seeds, is placed on the very summit of the bristle, like a kind of crown, the membranous wing at the point whence this bristle starts is divided, becomes opaque, is converted into an involucre, and assumes a form very like that of a champagne-glass; through the middle of this the seed-bearing bristle passes, and often projects half an inch beyond it: when the seeds have become perfectly ripe the capsules containing them fall off, and the bristle remains quite naked, except at the base, where it is surrounded by the champagne-glass-shaped involucre. Up to the period of publishing my Third Edition I supposed the naked bristle a complete production of nature, and erroneously described it as such,—an error which all subsequent authors have unfortunately copied; a fact that aptly illustrates the danger of appropriating the writings of others without something approaching an intelligent appreciation of the subject under notice.

This beautiful fern is abundant in the Atlantic Islands and in some parts of Ireland, but has not been found in Great Britain or on the Continent of

Europe: I cannot admit the rediscovery of Irish specimens, planted and growing in the Lake District, as a fact that warrants the extension of the range of this fern to England. The following Irish localities may be noticed:—Cork, in Glendine and Glenbour, near Youghal; near Bandon; under a shelf of rocks near the summit of Carrigeena, Kildorrery, in the North of the county; at a fall of the small river Clashgariffe; beneath a dripping rock in Temple Michael Glen; near Glandore, and on the banks of several lakes near Bantry. Kerry, Tork Waterfall at Killarney; a ravine of Cromaglaun Mountain; a great number of places on Tork Mountain to the very summit, an altitude of 1500 feet; Glengariff; Valentia Island; Gortagaree, between Killarney and Kenmare; Mount Eagle and Dingle, in Bantry Bay; and lastly, Blackstones, in Glouin Caragh; here the fern grows in a wild and romantic cave, the rocky walls of which have been for ages covered with a drapery of its overlapping fronds; hundreds of these hanging gracefully down form a pendulous mass of the loveliest green; the caudices spreading over the surface of the rock form a complete and tenacious net-work. Wicklow, Powerscourt Waterfall and Hermitage Glen.

The cultivation of this beautiful fern has occupied the attention of many botanists; I believe Dr. Mackay, of Dublin, and Mr. Ward, of London, were the first whose efforts were attended with success. Mr.

Andrews appears to have been still more successful. He says:—"I have had a case made purposely for cultivating this fern. I lined the bottom with zinc, and covered the frame-work with oiled lawn. I then planted my specimens in well-drained pots, in a compost of loam and coarse sand, interspersed with pieces of turf. I also suspended the roots across the roof of the case, attached to rods covered with bass-matting and moss. The plants were kept cool, and were well moistened daily, and I have now (October 24, 1843) a splendid display, the entire case being filled with fronds of large and strong growth. No other fern will thrive well in the Trichomanes case, the treatment required to cause that fern to flourish being destructive to the others. The Bristle Fern will live or even grow lazily in a glass with other ferns, but will never attain a vigorous state of growth. The cultivators of the Bristle Fern are under a mistake in supposing that the plant was in a fine state of fructification merely because the involucres had been produced. I have never seen the setæ perfectly exserted in cultivation, and the capsules attached in a ripening state." The main object to be achieved in the cultivation of this beautiful fern is an atmosphere loaded with moisture. In the drier counties of England this can only be obtained by a constant covering of glass. Several plans have been tried for accomplishing this. I will describe three, which I would wish

particularly to recommend. No. 1.—A small greenhouse, with brick walls, north aspect, corrugated glass, and the sun's rays totally excluded. Arrange upright strips, about an inch thick, of stone, slate or zinc, against the bricks: on the strips fasten galvanized zinc wire-netting: there will be a space between the netting and the bricks about an inch deep; fill this very carefully with Sphagnum thoroughly saturated with water, and on the face of the Sphagnum arrange the caudices of the Bristle Fern, which will be held in their places by the elasticity of the Sphagnum and the pressure of the netting. If the brick wall be built for the purpose, the taste of the builder will suggest many improvements on a plain surface. Mr. Allis, of York, has the upright strips made of wood, and has been very successful; but I do not like wood so well as any material that is not liable to decay, rust, or harbour insects. No. 2.—Procure a very large earthen pan, glazed within; fill this with water, and in the water arrange shells, crystals of quartz, aquatic Ranunculi, aquatic moss, Charas, &c., so as to hide the pan; then introduce two small gold carp, two crucian carp, six small minnows and a dozen water snails: I am particular in stating numbers, because any attempt to overload the water with animals will exhaust its power of supporting life, and the water is never to be changed. Procure a second pan, about half the size of the first and totally unglazed; support this on three

or four pedestals of stone placed in the water of the first pan, but let the water in the first pan just touch the bottom of the second; in this second pan arrange pieces of freestone, wet Sphagnum, mosses, Hymenophyllums, and a little very damp earth, composed of sand, leaf-mould and peat, and amongst this introduce the caudices of the Bristle Fern: the second pan will appear as a large island in the first; now cover the whole with a bell-glass, if you can procure one large enough, if not, a large hand-glass must be made on purpose; but, whatever the glass, cover it again with flannel; never leave the plant uncovered, and *never water;* the exhalation from the water will rise, and keep the plant in a constant vapour-bath. No. 3.—The third plan is recommended by Mr. Callwell. "In the year 1842 Mr. Andrews had given him a plant of the Bristle Fern having two fronds, one about six inches in length, the other partially developed. This he placed under a bell-glass shade which was about fifteen inches in diameter and eighteen inches in height. The fern was planted in pure maiden earth or virgin mould, a good drainage being obtained by placing inverted flower-pots in the receiver: through this mould he interspersed portions of charcoal. The temperature and moisture were carefully regulated, although but little watering was given to the plant. Great care was taken to keep the growing fronds from contact with the glass, for so sensitive and

delicate are the beautiful fronds when expanding, that should they rest against the glass they become blackened and unsightly. In the spring of 1845, so luxuriantly had the plant extended, that he removed the mass to a larger case. At that time there were about twenty fronds, all fully developed, and presenting that beautiful green hue and delicacy of texture which are the remarkable characteristics of the plant. The new habitat was a case with a neat mahogany frame, glazed on all sides, and having a deep tray of zinc; its measurements were three feet nine inches long, two feet six inches broad, and three feet three inches high, having a depth of tray or receiver ten inches. Height in the case, he considered of much importance for the proper encouragement of growth. The zinc tray was placed on a strong floor; the mass of plants were laid in soil similar to that above described, with the charcoal throughout, having previously put, as before, the inverted flower-pots, with the addition of cocoa-nut husks, so as in every way to facilitate perfect drainage. It was of great importance to the healthy growth of the plants to prevent any lodgment of moisture in the earth, or any tendency to the earth souring from undue excess or retention of moisture. To avoid this, he had placed around the case a rim of zinc, and by judiciously placing skeins of worsted, the drainage was directed to a proper course, and the

water easily carried off by means of a stop-cock, which could be turned when necessary. Other most important measures were to regulate light and temperature. The case was placed in a lobby, where it received only a subdued light, with but partial rays of the sun through the medium of green glass, and where the temperature was generally even throughout the year, for the plants would not bear excess of heat and cold: thus moisture, an equable temperature, and a modulated light were the essentials for effective growth."

45. TUNBRIDGE FILMY FERN. Tunbridgense.

Trichomanes tunbridgense, *Linneus*. *B. F.* 297.

The radicles are black, wiry and very slender: the caudex is long, black, slender, wiry and creeping. The fronds are drooping and pinnate; they consist of branched series of veins, each being clothed with a membranous or filmy wing, the structure in this respect being exactly similar to that of the Bristle Fern: the branches or pinnæ are alternate, and each is more or less subdivided; the divisions or pinnules are mostly in pairs, and the two sides of each pinna are alike; the margin of the wing is crenulate. The masses of seeds are nearly round, and each is seated almost at the extremity of a short vein which, in each

pinna, is situated next adjoining the midrib of the frond. The wing, or membranous portion of the frond, at this point forms a little cup, which is usually called the involucre, and the short vein already described enters the bottom of the cup, and the part inside the cup is surrounded with seeds, the rim or margin of the cup being notched and irregular.

A species of Filmy Fern occurs, under the name of Tunbridgense, in the Floras of Germany, France, Italy and Sweden. From the 'Flore Française,' we learn that in France it grows amongst moss on the trunks of trees; and a closely allied species, often indeed bearing the same name, is abundant in the Atlantic Islands. In Great Britain this little moss-like fern is generally found growing on the surface of rocks and stones in moist and shady situations; but I have also found it in Sussex growing abundantly on the surface of the soil under the shade of the common ling, and in Ireland it is very frequently seen covering the branches of decayed trees. In Scotland this pretty little fern does not appear to be of common occurrence: the following habitats have been kindly supplied me:— In Argyleshire, at Bullwood and Dunoon; in Dumbartonshire, abundantly on the banks of Loch Lomond; in Dumfriesshire, on rocks at Drumlanrigg Bridge. Descending southward, we find it in two northern counties, Yorkshire and Lancashire; then in two

Welch counties, Merionethshire and Glamorganshire; next in two western counties, Devonshire and Cornwall; and lastly, in two south-eastern counties, Sussex and Kent: in the latter county it grows only in one very restricted locality, closely bordering on Sussex. In Yorkshire, it has been found on rocks by a stream running down to the sea, at a place called Hayburnwyke, near Whitby; near Halifax; and near Todmorden. In Lancashire, at Cliviger; sparingly in caves at Greenfield; and near Coniston. In Merionethshire, at Crofnant, near Harlech; near Dolgelly; near Barmouth; in the vale at Festiniog; and at Rhayadr Du, near Maentwrog, where I observed it in some abundance above the fall. In Glamorganshire, at Melincourt Waterfall, where a large patch grows on a stone in the middle of the stream, close to the fall; and also at Brincon's, and the Cilhepste Waterfall. In Devonshire, in company with Unilaterale, on rocks adjoining the Plym, near Shaugh Bridge; and also at Bickleigh Vale, South Devon. In Cornwall, at Rough Tor, near Camelford. This little fern was formerly most abundant upon the High Rocks, at Tunbridge Wells, in Sussex, but large masses of it have been rolled off the rocks, like blankets, insomuch that it is now found but sparingly in this, its original and once profuse locality; it still occurs abundantly on the sandstone rocks at West Hoathly and Handcross; at the first of these, remarkable for

the rock called "Big-upon-Little," I have found it abundantly. In Kent, just within the limits of the county at Tunbridge Wells. In Ireland this fern is not generally distributed, being confined to those romantic districts in a few counties, which have for many years attracted the notice of tourists. In Cork, at Ballinhassig Waterfall, Lota Wood, Dunbullogue Glen, Glenbower and Killeagh, in very great luxuriance: it is still to be found in all these stations. In Kerry, in the vicinity of Killarney, it attains a degree of luxuriance and profusion that I have never observed elsewhere: it is often mixed with the Bristle Fern, and not only covers the rocks, but even clings to the bark of trees, ascending the branches to a great height, and presenting a very beautiful appearance In Wicklow, it occurs at Powerscourt Waterfall, Glencree, and several other places.

This and the following species are very easy ferns to cultivate: they may be used as an undergrowth or ground-covering for the Bristle Fern, but succeed equally well alone. The following plan will be found successful:—First, fill an ordinary flower-pot with wet Sphagnum, and invert it; then having prepared a compost of silver sand, loam and peat-earth, saturated with water, and mixed to a similitude of mortar, and having plastered this all over the inverted pot, arrange the matted mass of caudices of the Filmy Fern over the wet surface of the mortar, taking especial care

that the fronds hang in a natural position. It sometimes happens that the mass refuses to apply itself closely to the mortar, in which case a piece of fine galvanized zinc wire may be bound twice or three times round the pot, fern and all, taking care not to injure the fronds, which may be readily so arranged as entirely to conceal the wire: then fill a saucer with wet Sphagnum, and strew the surface with silver sand; place the inverted pot thus prepared in the saucer, and cover with a bell-glass, the rim of which will sink into the Sphagnum: the luxuriant growth of the fern is certain.

46. ONE-SIDED FILMY FERN. Unilaterale.

Hymenophyllum unilaterale, *Willdenow.* *B. F.* 301.
Hymenophyllum Wilsoni, *Hooker.*

The rootlets and caudices of the One-sided Filmy Fern offer no characters by which I can distinguish them from those of the Tunbridge species: the young fronds of both are convolute; they make their appearance late in the summer months, and usually remain green throughout the winter, turning completely black in the ensuing summer. The frond consists of branched veins, clothed with a membranous wing, the edges of which are delicately toothed: the wing on the main stalk is less apparent

in the One-sided than in the Tunbridge species; the pinnæ are always one-sided, being only half pinnate, and convex above, while those of the Tunbridge are usually flat: the One-sided Filmy Fern has a more erect, the Tunbridge a more horizontal, and indeed a somewhat drooping, habit, so that on the trunk of a tree, the fronds seem to rest one on another, like the tiles of a house. The involucre of the One-sided Filmy Fern is very different from that of the Tunbridge; it is elongate, swollen at the base, and its exterior edge perfectly even; when the seeds are mature it opens at the top, and, splitting down the middle, remains widely gaping. The reader is especially referred to the figures of these two delicate moss-like ferns, the smallest of all our species.

The range of Unilaterale, as far as known in foreign countries, is coextensive with that of Tunbridgense; the two species are frequently found growing near each other. The range of this species in Great Britain appears to be more extensive than that of Tunbridgense: it also seems to be a more northern species, and generally to prefer a greater elevation and more exposed sites; still, as already stated, the two plants are often found in close proximity, particularly about the waterfalls in the neighbourhood of Killarney. In the Shetland Isles it grows in one spot overhanging a subalpine stream near Ska, Unst, in great luxuriance and abundance. In the Orkney

Isles, on the summit of Langa, in Harris, at a probable elevation of 2700 feet. On the mainland of Scotland it has been found in Perthshire, on Ben Lawers; in Argyleshire, at Dunoon; in Dumbartonshire, on rocks on the banks of Loch Lomond; in Renfrewshire, on rocks and hills above Gourock; and in Dumfriesshire, in Girpel Lane, Kirkpatrick Juxta. Descending into England, we find it in four northern counties: in Cumberland, at Scale Force, on the rocks and screes; in Scaw Fell, High Still, Honister Crag, Gatesgarth Dale, Borrowdale, &c.; in Westmoreland, at Stock Gill and Dungeon Gill; in Yorkshire, at Turner's Clough, seven miles from Halifax, on the Oldham road; on rocks near Lower Harrogate; and near Greenfield; in Lancashire, on the Old Man mountain, sparingly in caves at Greenfield, commonly near Lancaster, on hills near Bury, at Thevilly, near Burnley. Passing into Wales, it is found in five counties: in Caernarvonshire, in the vicinity of Snowdon, Llanberis, Cwm Idwell, Nant-Frangon, &c. I formerly supposed I had found Tunbridgense in Caernarvonshire, but, on referring to the specimens, can only find the present species, which is most abundant on rocks and stones throughout the Snowdon district, at Rhayadr-y-Wenol, falls of the Lugwy, Capel Cerig, Rhayadr-Mawr, near Llanberis, &c. In Merionethshire, I have observed Unilaterale in abundance at Rhayadr Du, near Maentwrog, and at Rhaidr-

y-Mawddach, near Llaneltyd; it also occurs, growing in company with Tunbridgense, in the Vale of Festiniog. In Cardiganshire, on rocks close to Pont Bren, or the Parson's Bridge. In Brecknockshire, it is common among the mountains. In Glamorganshire, on rocks some way below the Melincourt fall, and also on rocks near the Scud-einon-Gam. Returning into England, we find this species in two western counties: in Devonshire, it occurs, in company with Tunbridgense, upon rocks and large blocks of granite adjoining the Plym, above Shaugh Bridge, and in much greater abundance at Westman's Wood, Dartmoor; also at Teignmouth, North Devon, and Bickleigh Wood, South Devon. In Cornwall, at Granite Tor; at Carn Brea, near Redruth, and in abundance at Rough Tor, near Camelford. In Ireland this fern is much more common than in England, and grows with a beauty and luxuriance that I have not witnessed elsewhere; it is more generally distributed over the island than Tunbridgense, and whereas Tunbridgense exhibits something like a preference to shade, warmth and shelter, Unilaterale establishes itself on bleak and exposed rocks. I subjoin a few localities: in Donegal, on the Ennishowen mountains; in Londonderry; in Antrim, by the Glenarve river, near Cushendall; in Down, in Tullamore Park and on the Mourne mountains; in Fermanagh, near Florence Court; in Galway; in Connemara; and I have seen specimens from

Maam, Roundstone and Oughterard. In Wicklow, on many of the rocky hills and waterfalls, at Glendalough, Hermitage Glen and Powerscourt Waterfall; in Kerry, on rocks and on trees, ascending to their very summits, among the Kerry mountains, and at all the waterfalls about Killarney; also in Valentia Island; in Cork, it is abundant in the glens near Youghal.

In cultivation, Unilaterale may be managed exactly as Tunbridgense, except that it delights in frequent syringings, under which Tunbridgense is apt to die.

47. FLOWERING FERN. Osmunda regalis.

Osmunda regalis, *Linneus*. *B. F.* 307, 310,

The rootlets are strong and fibrous; the caudex is tufted and very large, as might be anticipated from its capacity of annually producing such a weight of foliage; this caudex, in marshy situations, and when shaded by alders and other trees, rises full two feet above the surface of the ground, exhibiting an appearance somewhat like that of the tree ferns: I possess a living caudex of this fern that was found at West Hoathly, the upper part of which is naturally coated with the Tunbridge Filmy Fern. The young fronds, varying in number from six to twelve, make their appearance in May, arrive at maturity in August, and are destroyed by the first frosts of winter; their

growth is remarkably rapid and vigorous, and until nearly full-grown they have a reddish colour, like the shoots of many herbaceous plants; the fronds are fertile and barren; in both the length of stalk and frond is about equal. The fertile frond is broadly linear and pinnate: the pinnæ are four or five pairs in number, generally opposite, linear and pinnate; the pinnules are linear, generally alternate, attached by the midvein only, rounded at the tip, with the exception of the terminal apical pinnule, which is more acute. The apex of the frond is composed of a compact cluster of spikes; these spikes correspond to pinnules, of which only the midvein and a slight marginal wing is present, and to each of the lateral veins is attached a nearly spherical mass of seeds: these masses entirely supersede any leafy portion in pinnæ so converted; frequent instances, however, exhibit the apex of a pinnule in a leafy or barren state, while the base of the same pinnule is fertile: in an early stage of the frond these spikes appear crowded and pressed together, but they soon become more lax and diffuse, and at last entirely lose their rigid, compressed appearance. The barren frond differs in having the leafy portion continued to the very tip, where it terminates much as in other ferns. The lateral veins branch alternately from the midvein, soon after leaving which each is forked, and one or both of the branches is usually again divided, and all the branches run in

parallel lines to the extreme edge of the pinnule. The pinnules are jointed at the base, falling off after a sharp frost like autumn leaves.

This noble fern is of common occurrence throughout Europe, and a plant very similar, and generally bearing the same name, is found in North America. It is so generally distributed over the British Islands, in swampy places, that I forbear publishing the immense list of localities with which I have been furnished. In Ireland, particularly in Connaught, it is most abundant: in Connemara I have often observed it covering the small islands in the lakes, with a dense mass of its luxuriant fronds, those in the centre being more erect, those around the margins more pendulous. Of the pendulous habit I noticed a beautiful instance at Killarney, where it completely fringes the river between the lakes, and certainly forms a most prominent feature in that lovely but neglected portion of Killarney's far-famed scenery. So altered is the usual character of this fern that its long fronds arch gracefully over, and dip their masses of seed in the crystal water, while the bald-head coots, from beneath the canopy thus afforded them, gaze fearlessly on the visitors who are continually passing by. In the island of Achill the Flowering Fern very often fringes the little streams which descend from the mountains, rarely, however, rising above their water-worn channels, and thus escaping the violence of the mountain winds:

in a sheltered farm, in the possession of Mr. Long, it has forsaken these water-courses and established itself in the fields, where he found it a troublesome weed, and very difficult to eradicate. I was amused to see it towering above his cabbages and potatoes, and intermixed with oats and wheat. In Scotland this beautiful plant is common, and there also grows to a gigantic size: on the banks of Loch Fyne, where its habit is comparatively rigid and erect, I have measured fronds eight feet in height. In the bogs of Lancashire it is abundant, but less luxuriant, and it occurs not uncommonly in all the northern counties of England; it is also of frequent occurrence in North and South Wales, Cornwall and Devonshire, and is scattered in hundreds of localities throughout the southern counties approaching the vicinity of London, on Epping Forest, Keston Heath, and Kavanagh Wood, near Brentwood.

Although strictly a bog fern, Osmunda will continue to exist for many years in the ordinary soil of any garden; but, in order to make the plant not only live but thrive, care must be taken to supply it with either peat or bog-earth, well saturated with moisture.

48. MOONWORT. Botrichium lunaria.

Osmunda lunaria, *Linneus*. *B. F.* 313, 316, 319.

The roots and caudex of the Moonwort differ essentially from those of true ferns; the roots are stout, succulent and brittle, and cannot be properly defined as rootlets: the caudex is about the same size as the roots, perhaps rather stouter; it descends perpendicularly, and the roots issue from it at right angles, principally at two points, and arranged in a kind of whorl, but without any uniformity in this respect. Before the plant has felt the influence of spring, the frond exists in a quiescent state, but perfectly formed; it then appears like a simple stem, scarcely an inch in length and perfectly erect: on a closer inspection, the component parts of the future frond will be clearly perceived: the stalk is swollen and rather stouter than the upper part, the two branches of which face each other, the fertile branch of the frond being clasped by the barren or leafy part; and, the fructification being thus entirely concealed, the uppermost pinnæ are incurved, as if to give still further protection to the fruit: the whole is invested and completely enclosed in scale-like, alternate sheaths. As the spring advances the frond rapidly increases in size, until, in April, it makes its appearance above

ground, and in May or June attains its perfect development. Mr. Wilson observed, as long ago as 1830, that within the stem of the growing frond, at its base, was enclosed the frond of the ensuing year; and again, within this, also at its base, the frond for the next following year. Mr. Wilson having most kindly communicated to me this very interesting observation, I had the opportunity of carefully examining an abundant supply of specimens. I find the frond of the ensuing year in every respect perfectly formed; indeed, exactly in the same state in which it is found in the early spring, as above described, but somewhat smaller. The frond for the next following year was less perfectly formed, and its component parts were not to be made out without some difficulty; still it is evidently double, the fruitful and leafy portions being distinct from each other. These observations were made in May, while the frond for the current year was still growing with apparent vigour; so that we have the fronds for three successive years before us at the same time. In the plants I examined, the fronds were placed alternately; that is, having laid all the specimens before me, with the fruit on the right hand, and the leafy portion on the left, then the frond for the succeeding year invariably had the fruit on the left and the leafy portion on the right: the frond for the next year was again reversed, having the fruit on the right and the leafy

portion on the left. The stalk is very succulent, and rises in an erect position from the sheath-like scales already spoken of, thus totally differing from that of the true ferns: it is divided at about half its length into two branches, one branch bearing the leafy portion of the frond, the other the fructification; the leafy portion is pinnate: the pinnæ vary in number from three to seven pairs; they are somewhat fan-shaped, with their exterior edge slightly crenate; the veins in these pinnæ radiate from the sessile base, and are branched irregularly; they extend almost to the edge, but are never united at their extremities: the fruitful branch is pinnate, the pinnæ generally corresponding in number with those of the leafy branch: these lateral branches, or pinnæ, are frequently again divided, and bear a number of nearly circular cells, which, having attained maturity, open transversely, and, gaping wide, allow the seeds to fall out. A great number of varieties of this fern have been found, consisting in the greater or less amount of division of the fan-shaped pinnæ: other aberrations, which may probably be called monstrosities, are also of frequent occurrence, such as having two leafy branches to the frond; two, three, and even four of the fruitful branches; and in some instances the edges of the pinnæ are changed into seed-vessels. I incline to believe all the species of the genus Botrychium parasitical on the roots of grasses.

The Moonwort is found throughout Europe and Asia, extending even into Kamtchatka; and a very similar species, by some botanists considered identical, occurs in Newfoundland and Canada. It has a very extensive range in Great Britain; but, from the generally diminutive size, it may be supposed that it frequently escapes that notice which ferns of more conspicuous appearance can by no possibility elude. Its most abundant stations in England are in Surrey, Staffordshire and Yorkshire; and Antrim, in Ireland: but it is more or less generally distributed over the whole of the British Islands, including the Isle of Wight, the Orkney and the Shetland Islands. It affects dry, open heaths, elevated pastures and waste lands, its strong, succulent roots always creeping horizontally amongst the radicles of grasses. An unusual station was discovered by that accomplished and amiable botanist, the late Dr. Bromfield: "In rocky wooded ground under the cliff at East End, by Luccombe, a little beyond Rosecliff Cottage, as you go by the pathway to Bonchurch, in the shadiest recesses, amongst dead leaves; the place is difficult for strangers to find: the fern grows in narrow hollows between the masses of rock overhung by the brushwood." It would be inexcusable in me to publish the immense list of habitats, which, through the great kindness of my correspondents, I have received for

this fern; they would occupy more space than can be allotted to such a subject.

This is the most easy of all ferns to cultivate, never refusing to grow freely, if properly treated. First, dig up a large sod, where a few mature fronds are conspicuous among the grass; take care to have it broad enough and deep enough; so that not one of the roots of the Moonwort is exposed, much less injured: fit this sod in a large pot, a saucer, or even a box; place it in the open air, and be sure to add no compost or rich vegetable soil. Keep the grass cut short with a pair of scissars, and water in dry weather, for the purpose of keeping the grass green and vigorous. Acting on the belief that Botrychium is a root-parasite, the only requisite is to keep the nurse-plant in vigorous health.

49. ADDER'S TONGUE. Ophioglossum vulgatum.

Ophioglossum vulgatum, *Linneus*. *B. F.* 325, 330.

The roots and caudex of the Adder's Tongue much resemble those of Moonwort, but the rudimentary plant for the next year is exterior to the stem, and not enclosed within it, as in the latter; the caudex descends to a certain but not uniform distance, emitting at right angles various lateral, stout, succulent and brittle roots; the arrangement of these lateral

branches is somewhat in the form of a whorl; at the lower end of the caudex I have invariably found a single horizontal root, of very considerable length, even as much as ten inches: I have procured large pieces of turf filled with these plants and their roots, and have carefully removed the earth, expecting to find a connection between the plants by means of these horizontal roots: yet, though I constantly found them in contact, I never detected anything like union, but those of the upper series are frequently attached to the radicles of the grasses among which they grow. The detached external bud at the base of the stem contains the frond for the ensuing year in a perfectly erect position, and having the leafy part of the frond wrapped round the spike of fructification. The frond comes above ground in May, still retaining its erect position: it is composed of a long, smooth, pale-coloured, succulent stalk, which spreads into an ovate, rather acute, deep green leaf, and a straight, erect spike issuing from within the base of the leaf: the leaf is traversed in every direction by irregular veins, which are united at their extremities, forming a number of little closed cells. The spike is distinctly stalked, the stalk being sometimes three or four inches in length, but generally scarcely more than one inch: the spike itself is rather stouter at the base, and very gradually tapering to the tip; it is composed of two series of large, and nearly circular cavities, which

are filled with a pollen-like dust: when mature, each cell or capsule opens by a transverse slit, the pollen-like dust escapes, and the lips of the capsules remain separate and gaping.

The Adder's Tongue is a common plant on the continent of Europe, and is said to occur in almost every part of the world; but I have been unable to satisfy myself as to the identity or otherwise of the species. It is generally distributed over England, and in many places is very abundant, covering acres of meadow-land, and being considered highly injurious to the crop of grass, not only on account of its being disliked by cattle generally, but from its depauperating effect on the grass, upon which it acts as a root-parasite, although the actual parasitism has never been traced. In Wales, Scotland and Ireland, the plant is of less common occurrence, a circumstance perhaps attributable to the greater frequency in England of those low loamy pastures which it peculiarly affects. I have only on one occasion found it in a wood, and this was on the northern slope of Westhope Hill, in Herefordshire; here it was large and luxuriant, the tip of the frond elegantly turned back, and its appearance somewhat resembling that of the blossom of the Egyptian Arum. In Berrington Park, in the same county, it occurs in the utmost profusion. In reference to Ireland, the late Mr. Thompson observed of the

Adder's Tongue: — "Templeton remarks that it is partial to moist, loamy or clayey soil, especially meadows liable to be flooded after heavy rains: he particularizes a locality of this nature on the banks of the river Logan, about three miles from Belfast." Mr. Thompson, in company with Mr. Ball, found the Adder's Tongue in the south of Arran, off Galway.

The Adder's Tongue, in order to succeed well in a garden or pot, must be removed, like the Moonwort, with a large sod of the herbage amongst which it is found. If its connection with the herbage, of whatever nature this may be, is once disturbed, it is extremely difficult to get the plant to grow: it may perhaps live out the usual duration of the frond, but will be almost sure to be found wanting when looked for in the ensuing spring. Most cultivators consider this genus, like Botrychium, perfectly unmanageable. But this need no longer be the case; and it will be a boon to Science if any one will attentively study both genera under cultivation, keeping in mind the conditions indispensably essential to success. *First*, dig up the plants when perfectly mature, and with every particle of their roots intact; *secondly*, leave the grass or accompanying herbage of whatever kind, undisturbed; *thirdly*, let the soil, whether hungry, as in the case of Botrychium, or loamy, as in that of Ophioglossum, in which the plant is found growing, be the only compost allowed near it; and, *lastly*, cultivate

the herbage only, every effort being directed to keep that in vigorous health.

50. PIGMY ADDER'S TONGUE. Lusitanicum.

Ophioglossum lusitanicum, *Linnæus*. *B. F.* 331.

The roots are large in proportion to the size of the plant; they are brittle, succulent, and spread horizontally amongst the radicles of the herbage, from a somewhat elongate-ovate perpendicular caudex; from the crown of this caudex, accompanied by a few scarcely perceptible, withered, scale-like spathes, rises an erect stalk, which, in all my specimens, is divided below the surface of the soil into a barren and a fertile branch: the barren branch is generally linear, but sometimes lanceolate, and always obtuse at the apex: in one specimen there are two barren branches, the lower decidedly lanceolate, the upper decidedly linear: in a second specimen the barren frond is truncated, or cut off as it were, at half its length, and the upper portion replaced by three gaping capsules in a row; the fertile branch rises in a perfectly erect position, and is composed of a delicate stalk, which is very slender at its base, and gradually thickened upwards, until it terminates in a slender, somewhat club-shaped spike, which is composed of a fleshy central column, and two series of imbedded capsules, which have a

circular internal cavity: exteriorly they are shapeless, but opening transversely, exhibit themselves very conspicuously. The entire plant is very small.

This curious and diminutive plant is found in the Islands of the Atlantic, on the shores of the Mediterranean, in Greece, Italy, France, Spain and Portugal; also among the short herbage on the summit of rock in Petit Bot Bay, on the South coast of the Island of Guernsey, and also near the Land's End in Cornwall.

I have not seen or heard of cultivated specimens, but should treat it exactly in the same manner as the commoner species.

Of Drying and Preserving Ferns.

On these subjects I would observe, *in limine*, that all specimens selected for preservation should be as perfect as possible. Let no one imagine that a portion of a frond, or an immature frond, or the frond of a seedling plant, or a deformed frond, or a frond divided at the tip, or a frond in any respect monstrous or abnormal, can fairly represent a species. I regret to find a necessity for making the observation, that nine out of every ten specimens sent for me to name are, from one cause or other, untrue representatives of the species. From indulging a disposition to collect the *curious*, we are too apt to fall into the great error of neglecting the simply *true*. When practicable, frond, caudex and radicles should be preserved; but, if this be impracticable, at least have the frond entire, from the extreme tip to the extreme base of the stalk,

taking especial care that none of the scales be removed. Colour is a grand desideratum, and can only be retained by the use of the Botanical Paper. I have taken great pains to introduce this paper among botanists, and have invariably found them delighted with the result. Indeed, I do not hesitate to say, that before this paper was made there were *no* well-preserved collections of ferns, and now there are very few badly preserved. There should be a sufficiency of paper used to avoid too frequent changing; at least three or four thicknesses of paper between the fronds. I have always found it desirable to make the first pressure a very light one, and of short duration, because any alteration in the arrangement of the divisions of the fronds are readily accomplished whilst still flaccid, but not afterwards. No change takes place in the most delicate tints, if two sets of paper are used, one drying while the other is in the press. The press commonly sold for copying letters is the best I have yet met with for pressing ferns. As a substitute for this, and as being more portable, two elm or beech boards, three-fourths of an inch thick, cut to the size of the paper you prefer, and bound

together by two leather straps, is very efficient. Suppose that you have either a press or boards and straps at home or at your lodging, then carry a roll consisting of a dozen sheets of Botanical Paper in your hand, and put each frond in this as soon as gathered: each sheet should be cut up the back. A couple of vulcanised elastic bands, one near each end of the roll, will confine the paper sufficiently, without pressing the ferns too tightly. This roll must be emptied at night, and the contents transferred to the press or boards.

Explanation of the Plates.

The *numbers* used in these references are attached to the figures in the Plates: similar numbers are prefixed to the descriptions in the letterpress.

The names of genera are introduced *here* for the convenience of technical botanists, and printed in italics; thus, *Adiantum*; but they are omitted as unnecessary in the body of the work.

In a few instances our leading botanists have described the ferns under other names: in these cases such names are added in parenthesis, thus (Blechnum boreale).

In the present Edition it has been thought desirable to omit the figures of some of the larger and commoner ferns: not only their size, but in some instances their close resemblance to each other, render it extremely difficult to give satisfactory figures on so small a scale; but the greatest care has been taken to make the descriptions so complete and minute as to supersede the necessity for figures: the following are the names of the species which are not figured:—

4 Common Brakes, p. 55
20 Bree's Fern, p. 98
21 Roth's Fern, p. 101
22 Bennett's Fern, p. 103
23 Withering's Fern, p. 104
24 Lloyd's Fern, p. 107
25 Ehrhart's Fern, p. 109
26 Windermere Fern, p. 112
27 Rigid Fern, p. 114
28 Male Fern, p. 117
29 Common Lady Fern, p. 119
30 Alpine Lady Fern, p. 122

PLATE I.

Fig. 1.—True Maidenhair. *Adiantum* Capillus-Veneris. For description see p. 49.

Fig. 2.—Annual Maidenhair. *Gymnogramma* leptophylla, p. 51. The fructification is represented to the left of the figure.

Fig. 3.—Hard Fern. *Blechnum* spicant, p. 54 (= Blechnum boreale). Fertile and barren fronds; the fructification is represented to the left of the former.

Fig. 5.—Parsley Fern, or Rock Brakes. *Allosorus* crispus, p. 58 (= Cryptogramma crispa). Fertile frond; the fructification is represented to the right of the figure.

Fig. 6.—Polypody. *Polypodium* vulgare, p. 60. Frond attached to the caudex; the fructification is represented to the left of the frond.

Pl. I.

PLATE II.

Fig. 7.—Beech Fern. *Gymnocarpium* Phegopteris. For description see p. 62. (= Polypodium Phegopteris).

Fig. 8.—Oak Fern. *Gymnocarpium* Dryopteris, p. 65 (= Polypodium Dryopteris).

Fig. 9.—Smith's Fern. *Gymnocarpium* Robertianum, p. 68 (= Polypodium calcareum).

Fig. 10.—Wilson's Fern. *Cystopteris* Myrrhidifolium, p. 70 (= Cystopteris montana).

Pl II.

PLATE III.

Fig. 11.—Ray's Woodsia. *Woodsia* Ilvensis. For description see p. 78.

Fig. 12.—Bolton's Woodsia. *Woodsia* alpina, p. 75 (= Woodsia hyperborea). Perhaps a variety of the preceding.

Fig. 13.—Brittle Fern. *Cystopteris* fragilis, p. 78.

Fig. 14.—Dickie's Fern. *Cystopteris* Dickieana, p. 81. (Perhaps a variety of the preceding).

Fig. 15.—Holly Fern. *Polystichum* Lonchitis, p. 83.

Fig. 16.—Prickly Fern. *Polystichum* aculeatum, p. 87.

Fig. 17.—Willdenow's Prickly Fern. *Polystichum* angulare, p. 90. (Perhaps a variety of the preceding).

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Pl. III.

PLATE IV.

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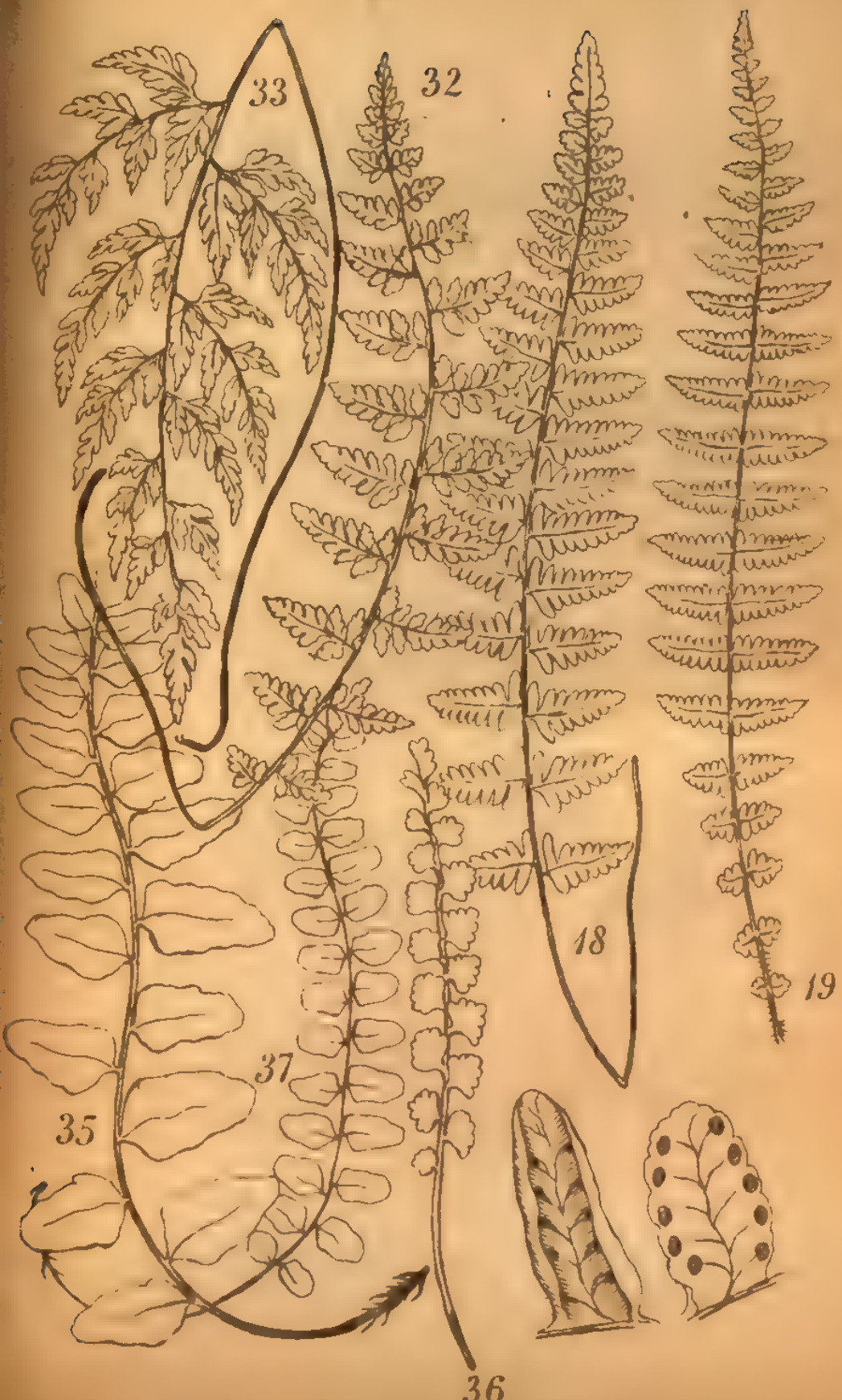
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Pl.V.

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